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Aligning Business Decision Making to Strategy

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Abstract

"Hurry up and wait" is a recipe for inefficiency. Some product development projects start and stop and start again, with team members being added and removed throughout the process. The cost of this lurching does not appear to be well quantified. Moving technical talent from one project to another may assume 100% engineering efficiency, which is not case. Hidden effects of engineers being moved include having to "spin up" on the new project and learn where the last team members left off (which may not be well documented), repeating initial work, and lowered efficiency and morale on the part of the engineers if the reason behind the moves was not well communicated or understood.

A lack of clear strategic intent leads to people or money being shifted between projects frequently and inefficiently. In the case of a project being completely shut down due to the shift, the short term effects are fairly obvious: the old project is stopped and will not complete until it is started up again. The long term effects could include opportunity costs of missed sales and additional cost to pull the project out of mothballs. When a project is not completely shut down, the effects are more difficult to quantify. Were the resources moved subject matter experts? Is the increase in schedule a one for one match or something more substantial?

Executive Summary

Chapter 1: Introduction

Strategy is an important part of any firm's new product development process. Without a well-formed strategy, projects without well-defined acceptance criteria are funded, greatly increasing the chance for product failure. When making decisions to move resources from one project to another, there are costs associated with those decisions, some obvious, others not. The information presented on strategy was gained through conducting literature reviews, personnel interviews, and online surveys.

Chapter 2: Literature Review

Secondary research was conducted in order to understand and identify what strategy and strategic characteristics are important to product development efforts. This was accomplished through a literature review focusing on product development strategic intent and entrepreneurial orientation. In addition, a search of the literature was conducted that focused on intellectual capital, knowledge management, and the six facets model. A summary of these literature reviews is contained in this chapter.

Chapter 3: New Product Development (NPD) Process

The chosen firm's NPD process is described from the strategic planning, through the annual plan to the gate process for an individual project.

Chapter 4: Methodology

Stakeholders of the product development process at the chosen firm were surveyed and interviewed to collect contextual data, experiences, and opinions on the strategy and decision communications processes being used within the organization.

Chapter 5: Results

Detailed information, along with summaries of the key information gleaned from these two sets of surveys, is documented in this chapter.

Chapter 6: Conclusions

Concluding discussions on strategic decision making, communication, and turnover are provided.

Chapter 7: Future Work

Possibilities for future work based on our research are outlined.

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Chapter 1 – Introduction

Background

The perception amongst engineers is that there is a greater than industry average churn amongst projects, with people being constantly shifted from one to another. When resources are re-distributed between projects, the firm's management does not know the full effects of their decisions on strategic plans. Members of the leadership team have stated that when a manager pulls a string, they do not know everyone who is affected. If the manager does not know the effects of their decisions in the short term, they certainly can't know what the long term effects their decision will have.

This lack of clarity leads to people or money being shifted between projects very frequently and inefficiently. In the case of a project being completely shut down due to the shift, the short term effects are fairly obvious: the old project is stopped and will not complete until it is started up again. The long term effects could include opportunity costs of missed sales and additional cost to pull the project out of mothballs. When a project is not completely shut down, the effects are more difficult to quantify. Were the resources moved subject matter experts? Is the increase in schedule a one for one match or something more substantial?

Understanding Why

In order to better understand why these inefficiencies happen, this study is taking a higher level view of the causes of these symptoms and on engineering efficiency. An initial effort to understand these causes led to a conversation with our industry advisor; she described her three reasons for why these symptoms happen in a firm:

1. No project management.
2. No concrete requirements (engineers creating their own requirements rather than Product Management creating requirements).
3. No accountability, the project manager and finance are the only ones tracking the schedule, engineers and managers are "off doing their own thing."

More discussion into why these inefficiencies are seen at the firm under study led to a list of the some of the common gross inefficiencies including:

- Moving people from project to project because of tactical decisions
- Possibly the number of layers of the engineering organization
- Lack of strategic thinking
- Product Line Management filling the funnel rather than leading Market-driven product development
- Innovation is not budgeted for (Strategic Growth Plan is not used for strategy)

If the firm were to move to Market-driven products from pursuit-driven products, changes would need to be made. The best use of engineering efficiency efforts would be to tackle these gross inefficiencies first.

Moving beyond the gross inefficiencies, another cause is rooted in the fact that most of the firm's R&D is internally funded, which leads to a careful consciousness of costs in other areas. The division of the firm selected for this research "runs lean," so that there are only ever "the right" number of engineers on a project team and no more. When team members stay on a project for its entire duration, start to finish, this can mean well defined roles and fast-tracking schedule by parallelizing of tasks. However, when team members are moved from the project, this can push out the schedule- possibly delaying deliverables to a point where the rate of return is no longer attractive. This delay in schedule and its concomitant miss on revenue-bearing deliverables may not be understood by decision makers.

As a government contractor, government changes in schedule affect the firm's business and in turn its staffing of projects. Government documents can be completely certain of a deliverable date, until that date moves, and then they are completely certain again. At the firm, a new product development project can be in progress, planning to meet the government's original deadline. When the deadline is moved, the project team may have to reassess the new timeline before them and may ramp up or down or adjust scope to fit these new bounds. The division of the firm that was surveyed for this research has had a higher than industry average turnover. This turnover leads to unexpected holes in project teams and a loss of domain knowledge within a group. Because knowledge capture and transfer is often not done well,

this turnover can also leave unanswered questions and knowledge gaps about product design or planning. Again, being a "lean" organization means that there is little time budgeted for succession planning for when resources are moved, quit, retire or become otherwise unavailable (unexpected serious illness, etc.). Senior leaders, who may be interested in making a staffing "trade," may not have visibility into the deliverables that the technical resource, who has been identified to be moved, is responsible for- and the revenue and schedule tied to those deliverables. In terms of strategy, senior leaders have visibility of the "hot new project" that has the potential for some dollar amount in revenue, but may not have in mind the expected revenue that is attached to the deliverables of this technical resource's current project.

This Investigation

These and other inefficiencies are seen at the firm. A clear understanding of the root causes requires exploration. Are people being moved as much as anecdotal evidence suggests? When people are moved, is it to chase a new "shiny object" and are projects on the strategic plan are being sacrificed? What are the costs that may not be taken into account such as loss of knowledge or employee dissatisfaction? Through interviews and surveys, we hope to shed some light in these areas and formulate suggestions to improve the efficiency of the firm's development process.

Chapter 2 – Literature Review

Strategy

The concept of corporate strategy has been reviewed from several alternative dimensions. Mintzberg defines strategy with five definitions – as a plan, ploy, pattern, position and perspective. (Mintzberg, 1987, p. 11) When acknowledged as a 'plan,' "strategy deals with how leaders try to establish direction for organizations, to set them on predetermined courses of action." (Mintzberg, 1987, p. 21) From his comparison of the five definitions of strategy, Mintzberg concluded that "strategy is not just a notion of how to deal with an enemy or a set of competitors or a market, as it is treated in so much of the literature and in its popular usage. It also draws us into some of the most fundamental issues about organizations as instruments for collective perception and action." (Mintzberg, 1987, p. 22) It is important for an organization to understand its strategic intent; "without strategy, an organization is a collection of individuals, each going his or her own way, or else looking for something to do." (Mintzberg, 1987 p. 26)

Strategic Intent

Strategic intent brings a unifying direction to an organization. "The strategically intent firm is aggressive, relentless, and incessant in the press for advantage through identification of opportunities, planning and execution, and garnering and building resources for leveraging and exploitation." (Mariadoss et al, 2014, p. 3) A clear and disseminated strategy can bridge the goals of the firm: "When you clarify competencies, your entire organization knows how to support your competitive advantage—and readily allocates resources to build cross-unit technological and production links." (Prahalad and Hamel, 1990, p.) The effects on resources, project costs, and competitive advantage due to the lack of strategic intent follow-through are difficult to quantify. While past literature hints that organizational slack may interplay with factors related to a firm's strategic intent, "the exact relationship between firm strategic intent and the level of slack held in the firm has not been addressed." (e.g., Bourgeois, 1981; Tan & Peng, 2003)

Strategy Execution

When effective strategy is developed and strategic intent is evident in an aggressive firm, one

would think that implementation of strategy should be simple for these leading companies, but creating a strategy and executing on a strategy are two different tasks. "Nielson, Martin and Powers (2008) in their research discovered that 60% of the employees of different companies rated their companies being weak when it came to effective strategy execution." (Higgins, J. M., 2005, p. 1). There appears to be a disconnect in literature and industry between creating sustainable change and effective strategy execution. Many models have been researched and developed for implementing strategy, but the broader context of the effects on daily operations could be addressed further. "The view mentioned is also supported by Corboy and O'Corrbui (1999) who argue that it is equally imperative to understand that strategy being applied and executed along with daily operations." (Higgins, J. M., 2005, p. 1)

Kotter's (2013) framework for effective strategy execution stresses that the key step missing between strategic planning and execution is the urgency process.

> An urgency process is a quantifiable and repeatable way to generate alignment, urgency, and engagement in a majority of employees in a company, division, functional area, or large team. Some of the elements it contains are:
>
> - Senior leadership team alignment around a market opportunity
> - An urgency team
> - Urgency initiatives to create alignment, urgency, and engagement
> - A way to capture names of urgent employees that want to volunteer to help
> - A means of measuring urgency to ensure at least 50% of the organization is urgent

Additional research has shown that most executions fail with the presence of a poor communication plan. The research of Kaplan and Norton (2005:44) revealed that as much as 95% of the employees in a typical organization are unaware of or do not understand their company's strategy.

Costs of Shutting Down a Project

While "a delay in the introduction of a new product may lead to loss and a negative return-on-investment" (Messica & Mehrez, 2002, p. 371), there appears to be little concern in the literature for the costs associated with ending projects early in order to free up resources for a new project. What is typically seen in the firm is that "upper management may decide to expedite development by allocating additional resources in order to shorten the time-to-market." (Messica & Mehrez, 2002, p. 372) What is

unknown is if the costs associated with shutting down the other projects are taken into account prior to the decision to switch priorities. There are monetary costs associated with loss of learning, storage of incomplete development items, etc. There are also more soft costs as those involved face uncertainty and stress when placed on a new project. Fields such as real options, open innovation, and transaction cost economics (TCE) deal with decision making choices presented to management. At the same time, creative destruction can influence management decisions on what projects to pursue.

Real Options

Real options refer to "application of option pricing theory to the valuation of non-financial or 'real' investments with learning and flexibility." (Borison, 2005, p. 1; Myers, 1977) Generally speaking, real options refer to the decision around an opportunity to invest (or not) and when to best exercise that decision. Real options stress such principles as "it is optimal to wait longer before investment" (Dixit, 1992, p. 108) which is echoed by Mercier who highlights the "value of waiting and learning before investing." (Mercier, 2002, p. 77) Real options thinking also emphasizes the value of strategic investments "such as research and development, where additional options are created by investments." (Mercier, 2002, p. 77) A high technology firm will necessarily need to pursue R&D strategically, so as to generate new, real options effectively. Volatility of the business impacts the value of real options, where "volatile businesses derive the most value by having the flexibility to exercise a diverse portfolio." (Mercier, 2002, p. 78)

Open Innovation

"Coined by Chesbrough (2003) in its initial form, 'open innovation' parallels the concerns of TCE in respect of where to set the boundaries of the firm and to what extent knowledge is flowing in and out of its borders during innovation work." (Remneland-Wikhamn & Knights, 2012, p. 279) Further, "the open innovation concept includes exchange of knowledge with the environment and an inbound and an outbound aspect, which refer to flows of knowledge to and from the innovation process." (Kortelainen, Kutvonen, & Torkkeli, 2012, p. 3) Resources such as knowledge are "dependent on its history as resources are accumulated over time" (Dierickx & Cool, 1989) (as cited in Korelainen, et al, 2012, p. 5). These resources deteriorate over time, requiring "accumulation through flows and thus time."

(Kortelainen et al., 2012, p. 5) Amplification "by time compression diseconomies" (Dierickx & Cool, 1989) means "that the direction of the firm is hard or even impossible to change in short run, causing delays to strategic intent and action." (Kortelainen et al., 2012, p. 5) This means that extra care must be taken when deciding to forgo a strategic project in favor of a more tactical one because it will take even longer to reach the strategic goal.

Companies are using new and innovative methods to achieve strategic goals. Open source is a boundary-blurring approach to innovation that typically involves software development by volunteers. A more corporate-appropriate approach might be the more recently-developed community source model, in which companies, rather than individuals, cooperate to develop software for their mutual use (Liu, Wu, Zhao & Zhu, 2010). This parallel runs closer than standard open innovation to the scenario of multiple development projects within a single high-tech business. In community source, participants share resources, including personnel, as needed for the development project, but problems with allocating work across the participants may lead to conflict and potentially a need for outsourcing (Liu, et al., 2010). Similarly, what we call internal source –the sharing of development resources across multiple internal independent projects– may cause conflict and difficulty as personnel are shifted to new projects at the cost of the projects in which they were already enmeshed. However, just as community source can be a highly effective approach to cooperative innovation across organization boundaries (Liu, Hull & Hung, 2017), we suggest that internal sourcing has the potential to be a highly effective approach to internal innovation.

Creative Destruction

"Creative destruction is a concept that, simply stated, means you must destroy in order to create." (Seland, 2010, p. 6) Joseph Schumpeter coined the term in his 1942 book: Capitalism, Socialism, and Democracy. Much like biological evolution, new ideas; technologies; processes; etc. will emerge that push aside the existing ones. When dealing with creative destruction, Kwon describes that there are three thresholds, "investment and exit thresholds before investment, and there is a threshold for exit after investment." (Kwon, 2008, p. xi) While this is generally applied to something already in production, it seems intuitive to place those same criteria on a work in progress. Kwon also found that "when the profit boost upon investment is sufficiently large, …an increase in volatility induces the firm to invest earlier." (Kwon, 2008, p. xi) However, from real options theory, firms should be waiting longer to invest "if (1)

the investment is irreversible, (2) the uncertainty regarding the investment is being resolved gradually in time, and (3) the investment can be flexibly postponed." (Dixit, 1992, p. 108)

With the fast pace of technology, it is important to track strategic technology shifts in order to understand when an advance is likely to start eroding the current base. William E. Halal mentions four keys to working in a technology industry which is constantly living in an age of creative destruction. The first is to "Track Strategic Technologies" (Halal, 2015, p. 42): companies are influenced by a wide variety of technology, "so it is essential to identify those that are strategic for a specific organization and monitor their progress." (Halal, 2015, p. 42) Doing so allows one to keep track of potentially disruptive technologies to one's existing base. It also leads to Halal's second point, "Develop Creative Opportunities… Disruptive technologies that could change an industry are especially important and require creative thought to develop viable new business ventures." (Halal, 2015, p. 43) Sharing knowledge allows for more rapid development. "Cooperation is crucial in today's knowledge economy because knowledge increases when shared." (Halal, 2015, p. 44) This cooperation is what Halal calls involving stakeholders. Stakeholders can be both internal (employees, management) and external (customers, industry experts). He goes so far as to recommend "cooperating even with competitors to produce better results for all." (Halal, 2015, p. 44) Halal's next point is to "Plan for Both Failure and Success" (Halal, 2015, p. 44). There is always risk involved with new technology, so it is wise to hedge your bets. "Disruptive technologies involve great uncertainty, so failures should be anticipated and planned for." (Halal, 2015, p. 44) Halal quotes Steve Jobs: "Killing bad ideas is not hard—what is really hard is killing good ideas." While the context was filtering out ideas to make new products from, it is easily applied to the existing regime. Companies must decide when it is time to kill off yesterday's good ideas to embrace new, better ones.

Organization and Management Control Systems (MCS)

In an ideal world, the firm would be able to invest in whichever opportunities came up without regard to availability of resources. However, in a budget constrained environment, firms must decide on which opportunities to pursue and which to let go. Gersbach and Wehrspohn (1998) determined that the "role of the budget constraint is crucial for the relative performance of organizational architectures. The presence of the budget constraint favors the hierarchy over the polyarchy." (Gersbach & Wehrspohn,

1998, p. 156) "Consistent with Brickley, et al. (1997) and Rotch (1993) the system of management control [MCS] is comprised of three variables: performance measurement, organization structure, and incentives." (Hammermeister, 2005, p. 15) The decision to end a project in favor of another is therefore a combination of how performance is measured within the organization, the structure (hierarchy vs. polyarchy) and how management is incentivized. "Given an uncertain environment, TCE posits that the system of management controls should exhibit the following characteristics: (a) Financial measures must be complemented with appropriate nonfinancial measures to provide decision-makers with a complete picture of business unit performance; (b) the organization should be structured so that decision rights are placed further down the organizational hierarchy, providing decision-makers with the flexibility to respond quickly; and (c) incentive compensation should be subjectively based, allowing latitude to adjust rewards for the vagaries of cause and effect present in a dynamic environment." (Hammermeister, 2005, p. 20) Hammermeister further advocates the Balanced Scorecard Concept (BSC) developed by (Kaplan & Norton, 1992) because it provides "managers with an integrated set of financial and nonfinancial performance measures." (Hammermeister, 2005, p. 156) Not only did he find "BSC usage had a more positive impact on effectiveness for those business units following a product differentiation strategy," he found that "the evidence was consistent… that the method of determining incentive compensation interacts with strategy in impacting effectiveness." (Hammermeister, 2005, p. iv) Followers of open innovation would agree with the assessment of MCS, with (Remneland-Wikhamn & Knights, 2012, p. 285) quoting (Teece, 2000) that "flexible boundaries, high powered incentives, non-bureaucratic decision making, shallow hierarchies and an innovative and entrepreneurial culture" are required attributes.

Resource Changes

Doing good, clear, documented, and well-communicated resource planning preparation up-front is not easy. Efficiency and agility must be balanced to achieve "operational ambidexterity." But agility is not achieved when one critical project is stalled or halted in order to support another so-called "critical project." Removing employees from a lean design team mid-project is almost never part of the plan. "Implementation is a critical facet where the company determines its success with a new technology/innovation by carrying out the plan. If the plan is not followed, the changes most likely will not happen. In short, the plan will fail" (Liao, Hull & Sriramachandramurthy, 2013, p. 14). There needs to

be a way to evaluate the strategic weights of each project and calmly evaluate the decision to move resources. Much of this work could be done in early discussions about risk and contingency planning. Then, later changes in the market or environment would lead to an already thought-out response from the firm, like following a premeditated contingency plan, rather than a hasty reaction.

Most new product development projects require multi-disciplinary teams, which means different functional leads coordinating on resource planning with different targets in mind. Kaplan and Norton (2005:47) pointed out that the problem with a lack of resources lies in the alignment with the strategy between the various corporate functions. There will be various goals and plans within a business unit, but they should be aligned as best as possible.

Training

Training is essential for making a system work. For success in plan execution, it is recommended "to budget significant time and money, to provide documentation, to choose the most appropriate approach to training, and to bring in power users" (Liao et al., 2013, p. 15). Training on technical or project management subjects is useful and needed in general, but there is also specific project training that is often undertaken informally and learned by team members as the project initially ramps up. As this training happens naturally and informally, it is rarely fully documented and becomes difficult to transfer to a new team member if there is a sudden resource change. The more sudden and permanent the resource change, the greater the difficulty in knowledge transfer. Rolling a resource off of a project while they ramp onto their next one is one way that some firms allow time for some natural answering of questions as they arise from the new team member.

Intellectual Capital and Knowledge Management

Intellectual capital (IC) and knowledge management (KM) have both been studied in relation to a firm's innovation. "A firm's KM capability may be defined as "the firm's ability to create, transfer, integrate, and leverage knowledge" (Tanriverdi (2005) as cited in Hsu and Sabherwal, 2011, p. 629). When a team is formed, relevant project knowledge is stored in the people of that team and in their interactions and relationships. Informal networks and relational knowledge aid innovation efforts.

"Social capital implies that greater knowledge is embedded in relationships among individuals. It

is likely to lead to more knowledge being stored in organizational systems, routines, and so on." (Walsh and Ungson (1991) as cited in Hsu and Sabherwal, 2011, p. 630). Strong bonds between project team members can allow knowledge to be shared and acted on more efficiently. "Conversely, weak ties (which reflect a lower level of social capital) impede transfer of knowledge, especially when knowledge is not codified" (Hansen (1999) as cited in Hsu and Sabherwal, 2011, p. 631). When a team member is moved regularly off of a project team after being "spun-up," the time and effort put into training that person now has a lower return on investment (ROI) and some of the knowledge built into the team structure and interactions is lost. When individuals are moved on short notice, there often is not time to transfer the knowledge well and great inefficiencies are accepted.

Hsu and Sabherwal's 2011 study shows "support for the following overall causal path: IC → KM capability → innovation → firm performance." (Hsu and Sabherwal, 2011, p. 637-638). Human capital was the one dimension of IC that had a direct effect on innovation, social capital and organizational capital did not. New product development projects, creative designs, and process improvements all rely on the skills, knowledge, and experience of each team member to come to fruition. When a team of employees work on a project for a length of time, team synergies are found and leveraged in a way that is difficult to document and relies on the interactions of the team members. The importance of knowledge management in innovative pursuits, especially transfer of knowledge within the organization, should be stressed, but cannot take the place of the having the team remain generally intact.

Employee Engagement

"[R]esearch has demonstrated that work-engaged employees have lower levels of turnover intentions than non-engaged employees." (Caesens, Stinglhamber, & Marmier, 2016, p.1) One way to determine turnover employee engagement is through surveys. Analysis of employee feedback should be evaluated with the two filters shown in the figure below. A strong team that stays with a project through much of development will have higher loyalty to both the project and the company. High turnover on projects can decrease employee engagement and lead to increased employee turnover for the company. "Management reports that the total cost of replacing an employee is estimated to be between 90 percent to 200 percent of his/her annual salary." (CityBusiness, 2016, p.1) Analysis shows how great the impact of employee turnover is to knowledge and finances.

One way to improve employee engagement is to "show that the company is committed to a long-term relationship, one that will survive short-term pressures" (LID, 1). The short-term pressures of multiple "hot" projects can be a good problem to have and can be better handled with improved up-front planning.

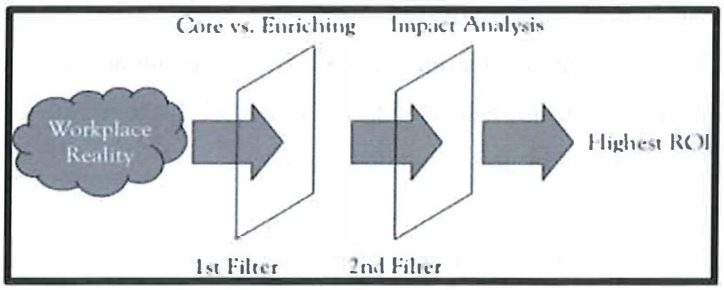

Figure 1. Filters for Employee Engagement. Source: PerformancePoint, LLC (Federman, 2009)

Six Facets Model

"Organizational fitness is often achieved by making changes in business operations, changes which frequently involve the use of a new technology" (Kearns, Taylor, and Hull, 2005, p. 77). Kearns, et al. (2005) list the six facets of technology management as Technology Evaluation, Product & Process Integration, Planning, Implementation, Training, and Change. Their six facets tool can be used to aid the process of technology management, from technology selection to implementation; it "summarizes elements which should not be overlooked when attempting to effectively implement change in an organization." (Kearns, et al., 2005, p.78)

Focusing on the facet of "Change" aids analysis of documentation and communication. During periods of project churn or team member turnover, documentation becomes more critical than ever. Spinning up new team members without clear documented processes, especially when the previous contributor is unavailable for questions, unnecessarily wastes valuable time and money. On documenting and communicating changes, the authors write, "having decision history can be instrumental in the event of turnover as well as in the future when architecture is questioned. Also, without understanding the

reasoning behind a change, members of the organization may not accept it." (Kearns, et al., 2005, p. 80) If information critical to product design or project success is undocumented and kept solely or mostly in tribal knowledge, turnover can have a much more devastating effect on the success of the project. Not clearly communicating the reason behind a change, in staffing, direction, or strategic needs of the business leads to less buy-in from team members.

The "Planning" facet highlights the importance of scope definition. A clear definition of scope can help to keep the project on schedule and on budget. The scope helps to maintain the project's purpose, which allows for clear alignment of projects to strategic goals.

Using the six facets model as a guide, the following questions are investigated:

1) Has the business been following its strategic plan?
2) Are projects being staffed correctly to achieve the stated strategy?
3) Are employees being affected by project staffing decisions?
4) Is the business losing knowledge based on resource transfers?

Strong leadership is needed for both authority and communication. "A strong central leader is necessary to keep a project on track. This is especially important if a change involves many functional groups, or even multiple brands. Having one leader to represent each group is often not enough to maintain authority and responsibility for a project." (Kearns, et al., 2005, p. 80). If leadership does not regularly and consistently communicate the vision to the team, the goals of the project may not be well understood throughout the levels of the project organization. If these goals are not understood, it becomes difficult to discuss product development process in a useful way.

The methodology of the Kearns, et al. Bath and Body Works (BBW) case study and the Cox, Christen, Deletic, and Fatimilehin (2007) financial services case study, which focused more on quantitative survey data, could be used as a model for a case study grading effort. In the Cox, et al. (2007) case study, "All survey respondents except 1 indicated that they understood the goal/vision of the project demonstrating that because they understood the goal they could therefore identify system weaknesses in relation to the goals." (Cox, et al., 2007, p. 37) In this case study, it should be established if strategy is understood by employees and managers before asking questions about improving strategic alignment.

Scope definition during the planning stages means expectations can, and should, be clearly set early in the project. This allows for improved accountability for teams and individuals. In the BBW case study, questions relating to the "Planning" facet "focused on team composition, member selection criteria, experience and involvement, scope, schedule and budget changes and challenges." (Kearns, et al., 2005, p. 87) Turnover was listed by BBW respondents as a major challenge in shakedown (the time period after roll-out until the return to normal operations) and communication was listed as a process weakness (Kearns, et al., 2005, p. 99). Questions could be written to find if these two elements are also seen as problems at the firm during recent product development efforts.

Cox et al. (2007) conducted survey research that validated Kearns et al.'s (2005) findings based on a semi-structured interview case study approach in a different setting. Hull, Baroody and Payne (2007) highlight a question they argue is overlooked in the original six facets model: Whether to make the change at all, or simply stay the current course. In a variation on this theme, Luxmore & Hull (2010) suggest that the model can be strengthened by considering potential negative consequences of the change being evaluated. In the current study, we are careful not to overlook these issues. Liao et al., (2013) offer insights into the six facets model based on a high-technology innovation setting that are also useful in the context of this study, including the importance of sticking to a plan rather than modifying it frequently over time. However, ours is the first study to use both semi-structured interviews and survey data to apply the six facets model to innovation in a high-technology setting.

The Cox, et al. (2007) study included both in-person interview and web-based survey response questions. This case study will focus on web-based survey response questions to collect enough data to be statistically relevant and use interviews to supplement the data collected in surveys.

Entrepreneurial Orientation

Entrepreneurial Orientation (EO) "has generally been conceived of as an organization decision-making proclivity favoring entrepreneurial activities." (Lumpkin & Dess, 1996) (as cited in Covin & Wales, 2011, p. 677) One of the key concepts originally defined by Mintzberg (1973) describes it as a "managerial disposition characterized by the active search for new opportunities in uncertain environments through which dramatic growth might be realized." (Covin & Wales, 2011, p. 679) If an organization is on the high end of the entrepreneurial scale, might it chase perceived opportunities too

quickly and abandon work in progress for the promise of new growth? Or is the problem the opposite, where the organization is too conservative and waits for the opportunity to be a near certainty before entry and therefore must therefore play catch-up to meet its goals? Measuring the organization's EO and comparing it to its proclivity for cannibalizing projects may yield some insights as to whether the organization is following Khandwalla's "bold, risky, and aggressive decision-making" (Khandwalla, 1976/1977, p. 25) (as cited in Covin & Wales, 2011, p. 679) or "a more cautious, stability-oriented approach." (Covin & Wales, 2011, p. 679) The measurement of EO revolves around "innovativeness, risk taking, and proactiveness - that must positively covary in order for an EO to be manifested" (Miller (1983), as cited in Covin & Wales, 2011, p. 680). A number of measurement models are available, both formative and reflective as shown by Covin & Wales (2011). As part of our methodology, we will use a reflective model where "the latent construct is modeled as producing its measures" (Covin & Wales, 2011, p. 682). This model is used "when the presumed direction of causality is from the construct to its measures" (Covin & Wales, 2011, p. 682), meaning the organization being modeled produces evidence of risk taking, innovativeness and proactiveness because of its Entrepreneurial Orientation.

Chapter 3 – New Product Development Process

The new product development process at the firm under review starts with the Strategic Growth Plan (SGP). The annual SGP is developed by each segment of the business and projects planned out for the next three fiscal years. The SGP defines key areas for growth of existing products, adjacent markets to expand into, and potentially new markets to pursue.

Following the SGP, every year the segments develop an Annual Operating Plan (AOP) that defines the specific areas of the SGP that will be addressed in the upcoming fiscal year. Internally funded research and development (IRAD) is allocated to a number of projects based on their priority. Projects that will span multiple fiscal years will get an allocation for the current FY with projects made for remaining funding needed in following years.

During execution of a project, a gate process is used where five gates need to be passed with a yes/no decision prior to launch. While typically depicted as a linear process, activities can be performed sequentially, or in parallel.

Between the major phases, a CheckPoint Review Board (CRB) meets to make informed decisions on the future of the project. They make go/no-go or redirect decisions based on risks and additional resource requirements. The CRB will meet whenever all required deliverables for that CheckPoint have been delivered. The CRB will also meet if the project goes "out of bounds," meaning something large has changed that requires immediate feedback by the CRB. Reasons for going "out of bounds" vary from external influences (shift in customer focus), resources were not delivered, etc.

Members of the CRB include a chair, business leader, engineering, operations, sales, marketing, product line management and finance. The actual makeup of the board depends on the classification (A, B, or C) made by the chair. Class A projects are high risk, complex projects that require much more resources. Class B and C projects are much smaller and involve less risk. Class A projects typically consist of the chair being the group president and the other members being VP or Director level

executives. Class C projects, on the other hand, are typically chaired by a product line leader and members are a Director or Senior Managers.

The division of the firm being surveyed is working through a change process to become a more strategically aligned organization. Using the Six Facets Model to grade the change management effort so far could help the firm highlight what's been done well to date and where opportunities might lie for improvement as this change effort continues. The methodology of the Kearns, et al. Bath and Body Works (BBW) case study could be used as a model for this grading effort. (Kearns, et al., 2005, p. 79)

The division of the firm being surveyed is now in Year 1 of Executing to Strategy. There is now monthly status reporting in this division on how business decisions matches the stated strategy and quarterly reporting on this strategy-alignment to Headquarters. A case study of the change management process with regards to strategy could assist leadership and middle managers as the process continues.

Our industry advisor highlighted "Change" and "Planning" as two of the Six Factors that the firm could most work on improving. Her work in Strategy organizations also connects strongly with the "Technology Evaluation" facet. Investigations of these facets at the firm are further discussed in the case study sections in Chapters 5 and 6.

Chapter 4 – Methodology

Similar to Cox, et al (2007), our methodology was to conduct surveys that were broken up into a set of questions for Senior Leadership for strategic input and an Employee survey for a more tactical view. Questions were a mix of open-ended and forced-choice (multiple choice, yes/no). Data collected from the surveys was a combination of qualitative and quantitative. Surveys were anonymous to allow for more unbiased results. Our approach for collecting data was to start at the top with senior leadership and work down to engineering. Our first method of collecting data from senior leadership was through in-person interviews. The engineering survey was distributed after the senior leadership survey, via an online questionnaire.

Senior Leadership Questions (SLQ)

SLQ #	Question	Literature Link
Question Group 1	In the following scale items, the terms risk-taking, innovativeness, and proactiveness are used. As employed in these items, risk-taking refers to a willingness to commit resources to projects, ideas, or processes whose outcomes are uncertain and for which the cost of failure would be high. Innovativeness refers to a the exhibition of experimentation, exploration, and creative acts as reflected in, for example, new products/services, new process technologies, new methods of operation, and new business strategies. Proactiveness refers to engaging in forward-looking actions targeted at the exploitation of opportunity in anticipation of future circumstances, as would be typical of firms that lead and/or pre-empt the actions of others (e.g., market pioneers, early adopters of new technologies).Given these definitions, please indicate the extent to which you agree with the following statements. (All items rated on 5-point, Likert-type scales ranging from "Strongly disagree" [=1] to "Strongly agree" [=5].)	
1.1	If an entrepreneurial firm is operationally defined as "one that engages in product-market innovation, undertakes somewhat risky ventures, and is first to come up with 'proactive' innovations, beating competitors to the punch," then my firm is an entrepreneurial firm.	Creative Destruction (CD), Entrepreneurial Orientation (EO)
1.2	My firm characteristically exhibits high levels of risk taking, innovativeness, and proactiveness.	CD, EO
1.3	My firm often takes calculated risks by pursuing innovative	CD, EO

	initiatives before potential rivals recognize the opportunities at which our initiatives are targeted.	
1.4	Risk taking, innovativeness, and proactiveness are equally inherent to my firm's overall business orientation.	CD, EO
1.5	The innovative initiatives pursued/funded by my firm are often somewhat risky and industry leading (i.e., chosen in advance of other firms' potentially similar initiatives).	CD, EO, Strategy (S), Strategic Intent (SI)
1.6	My firm concurrently manifests risk taking, innovativeness, and proactiveness.	CD, EO
1.7	My firm often pre-empts its rivals by being an early leader with innovations whose successful outcomes cannot be assured.	CD, EO
1.8	In general, my firm is on the cutting edge when it comes to exploiting entrepreneurial opportunities because of our desire and demonstrated ability to embrace novel (and often risky) innovative initiatives ahead of our rivals.	CD, EO, S
Question Group 2		
2	How do you rate your firm on its ability to effectively execute strategy? (1-5 scale, 1 weak, 5 strong)	SE
3	How often do you see the strategy being applied and executed in daily operations? (1-5 scale, 1 never, 5 always)	SE

4	Do you understand the firm's strategy? (Yes, No, Somewhat, Don't care to know)	S
5	How many years have you worked at your division of the firm?	
6	During that time period, how many projects have you overseen?	
7	How many of these projects were cancelled to transfer resources to a higher priority project?	Real Options (RO), Resource Change (RC)
8	How many of the cancelled projects were part of the strategic plan?	Open Innovation (OI)Strategy (S), Strategic Execution (SE)
9	How many of the cancelled projects were started up again at a later date?	RO, S, SE
10	How many of these projects were not cancelled but had staff moved off to a higher priority project?	RO, RC
11	How many of the downsized projects were part of the strategic plan?	OI, RO, S, SE
12	How many of the downsized projects completed on time?	RO
13	How many of the projects were increased by pulling in resources from other projects?	RO

14	How many of the increased projects were part of the strategic plan?	OI, RO, S, SE
15	Of these increased projects, how many were completed on time?	RO
16	Of these increased projects, how many met the financial expectations (orders, revenue, etc.)?	Management Control Systems (MCS)
17	How many projects have had significant scope change (ex: large design change after months of engineering effort)?	Six Facets Model(SFM)
18	When people moved off of a project, how much time passed between their finding out they'd be changing positions and their starting the new one full-time? (enter time in days)	RC
19	How well do you feel the reason for these project changes are communicated to employees? (1-5 scale, 1 Poor, 5 Outstanding)	Employee Engagement (EE)
20	How well do you think documentation and knowledge capture (of requirements/design decisions/lessons learned) happened on these projects? (1-5 scale, 1 Poor, 5 Outstanding)	SFM
21	Was time allotted for clean handoff and/or documentation? (Yes, No, Somewhat, Don't know)	RC
22	Does training/standard practice exist on knowledge capture/hand offs? (Yes, No, Somewhat, Don't know)	Training (T)

23	Who planned training or team on-boarding/ramp up for new members of the project team?	
24	What were the main challenges in providing training to new members of the project team?	
25	Given the same set of resources (time, staff, budget), what would you do differently?	
Question Group 3		
26	What measures are used to track the performance of the business unit? (financial, non-financial, both)	TCE, MCS
27	At what level are resource shifts typically made (CEO, Pres, VP, Senior Manager, Manager) or are the decisions made in a cross-functional committee?	TCE, MCS
28	Is incentive compensation based on objective or subjective criteria? (1-5, 1 = purely objective, 5 = purely subjective)	TCE, MCS

Engineering Questions (EQ)

EQ #	Question	Literature Link
Question Group 1	In the following scale items, the terms risk-taking, innovativeness, and proactiveness are used. As employed in these items, risk-taking refers to a willingness to commit resources to projects, ideas, or processes whose outcomes are uncertain and for which the cost of failure would be high. Innovativeness refers to a the exhibition of experimentation, exploration, and creative acts as reflected in, for example, new products/services, new process technologies, new methods of operation, and new business strategies. Proactiveness refers to engaging in forward-looking actions targeted at the exploitation of opportunity in anticipation of future circumstances, as would be typical of firms that lead and/or pre-empt the actions of others (e.g., market pioneers, early adopters of new technologies).Given these definitions, please indicate the extent to which you agree with the following statements. (All items rated on 5-point, Likert-type scales ranging from "Strongly disagree" [=1] to "Strongly agree" [=5].)	
1.1	If an entrepreneurial firm is operationally defined as "one that engages in product-market innovation, undertakes somewhat risky ventures, and is first to come up with 'proactive' innovations, beating competitors to the punch," then my firm is an entrepreneurial firm.	Creative Destruction (CD), Entrepreneurial Orientation (EO)
1.2	My firm characteristically exhibits high levels of risk taking, innovativeness, and proactiveness.	CD, EO

1.3	My firm often takes calculated risks by pursuing innovative initiatives before potential rivals recognize the opportunities at which our initiatives are targeted.	CD, EO
1.4	Risk taking, innovativeness, and proactiveness are equally inherent to my firm's overall business orientation.	CD, EO
1.5	The innovative initiatives pursued/funded by my firm are often somewhat risky and industry leading (i.e., chosen in advance of other firms' potentially similar initiatives).	CD, EO, Strategy (S), Strategic Intent (SI)
1.6	My firm concurrently manifests risk taking, innovativeness, and proactiveness.	CD, EO
1.7	My firm often pre-empts its rivals by being an early leader with innovations whose successful outcomes cannot be assured.	CD, EO
1.8	In general, my firm is on the cutting edge when it comes to exploiting entrepreneurial opportunities because of our desire and demonstrated ability to embrace novel (and often risky) innovative initiatives ahead of our rivals.	CD, EO, S, Strategic Intent (SI)
Question Group 2		
2	How many years have you worked at your division of the firm?	
3	Do you know the five pillars of the firm's strategy? (Or easily know where to find them?)	S

4	Do you understand the firm's strategy?	S
5	Do you know our core competencies? (Or easily know where to find them?)	SI, SE
6	Do you know how the work you are doing connects to the firms' strategy or core competencies?	SI, SE
7	Of the projects you've been involved with, how many were part of the strategic plan for the company?	RO, OI, S, SE
8	How would you rate your firm on its ability to effectively execute strategy?	SE
9	How often do you see the strategy being applied and executed in daily operations?	SE

Question Group 3		
10	How many of the projects you have been involved on were cancelled to transfer resources to a higher priority project?	Real Options (RO)
11	How many projects were not cancelled but you were transferred to a higher priority project?	RO, SE
12	If you have been moved off a project, do you feel your career was helped or hurt by these moves?	TCE, EE
13	If you have been moved off a project, do you feel the firm (and overall completion of priority projects) was helped or hurt by these moves?	TCE, EE
14	How well do you feel the reason for these project changes were communicated to you? (1-5 scale, 1 Poor, 5 Excellent)	EE
15	How many projects have you been on that have had significant scope change (ex: large design change after months of engineering effort)?	TCE, SFM
16	How well do you think documentation and knowledge capture (of requirements/design decisions/lessons learned) happened on these projects? (1-5 scale, 1 poor, 5 excellent)	SFM
Question Group 4		

17	I feel loyal to my… (Project Team, Discipline Team, Neither, Other)	EE
18	How many people do you know who left the company due to (or you believe due to) being shifted on projects?	EE
19	Relating to the question above about people you know (or believe) left the company due to being shifted on projects: Please provide names so we can provide an accurate count (names will not be provided in the results):	EE
20	Optional: Please share any thoughts you may have on how the firm can better align decisions to strategy, and how best to communicate these ideas to decision makers. Your honest feedback is extremely helpful.	EE

In-Person Interviews

In addition to the online surveys, in-person interviews will be conducted to collect any additional feedback that may not come from the online survey. At a minimum, the survey questions can be asked. If the interviewee had not already completed the online survey, the inputs can be added to those results. If they had, then the inputs will not be added but can be used to correlate to the overall results.

Origin of Survey Questions

Questions one through eight on both the Senior Leader and Engineer questionnaires are an alternative first-order reflective EO scale developed by Covin & Wales (2012). EQs 3 and 5 were posed by our Industry Advisor, Lori Thompson. The remaining questions were developed by the authors.

Chapter 5 – Results

General Information

The senior leadership survey was sent to 72 managers and above within the engineering organization. An email request was sent with the option to take the online survey or opt for an in person interview. A total of 34 managers took the online survey and two opted for in-person interviews. Of those taking the online survey, only 20 completed the full survey. It is unclear the reason for not finishing, though one person did report a technical error that closed the session out early.

The employee survey was online only and was sent out to 939 engineers within the division, with 208 respondents and 193 of them completing the full survey.

Eight of the respondents failed to provide a valid response to the years of service question, the remainder are broken up into the following categories:

Years of Service	Employee Total	Employee %
>16 years	41	19.71%
11-16 years	54	25.96%
6-10 years	59	28. 37%
1-5 years	36	17.31%
<1 year	10	4.81%

Entrepreneurial Orientation

The first eight survey questions were the same between leadership and employees and are summarized together. Results were given on a 1 to 5 scale, where 1 = Strongly Disagree and 5 = Strongly

Agree. Each of the questions below is broken up by raw count for each of the response categories along with a percentage response rate for both the leadership and the employees. An overall average is provided for the two groups as well as a standard deviation. The data was further correlated against years within the company.

NOTE: The leadership portion is left as one group. Only 26 of the 36 respondents completed that portion of the survey and 65% of those were in the > 16 year category and 23% were in the 11 - 16 year group, making it difficult to gather much meaning from further breakdowns of the data.

Q1: If an entrepreneurial firm is defined as "one that engages in product-market innovation, undertakes somewhat risky ventures, and is first to come up with 'proactive' innovations, beating competitors," then my firm is an entrepreneurial firm.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	total
engineer raw count	18	49	35	72	24	198
engineer %	9.09%	24.75%	17.68%	36.36%	12.12%	100%
leader raw count	3	12	10	7	4	36
leader %	8.3%	33.3%	27.8%	19.4%	11.1%	100%

Average employee response: 3.17, Standard deviation: 1.19

Average leader response: 2.92, Standard deviation 1.16

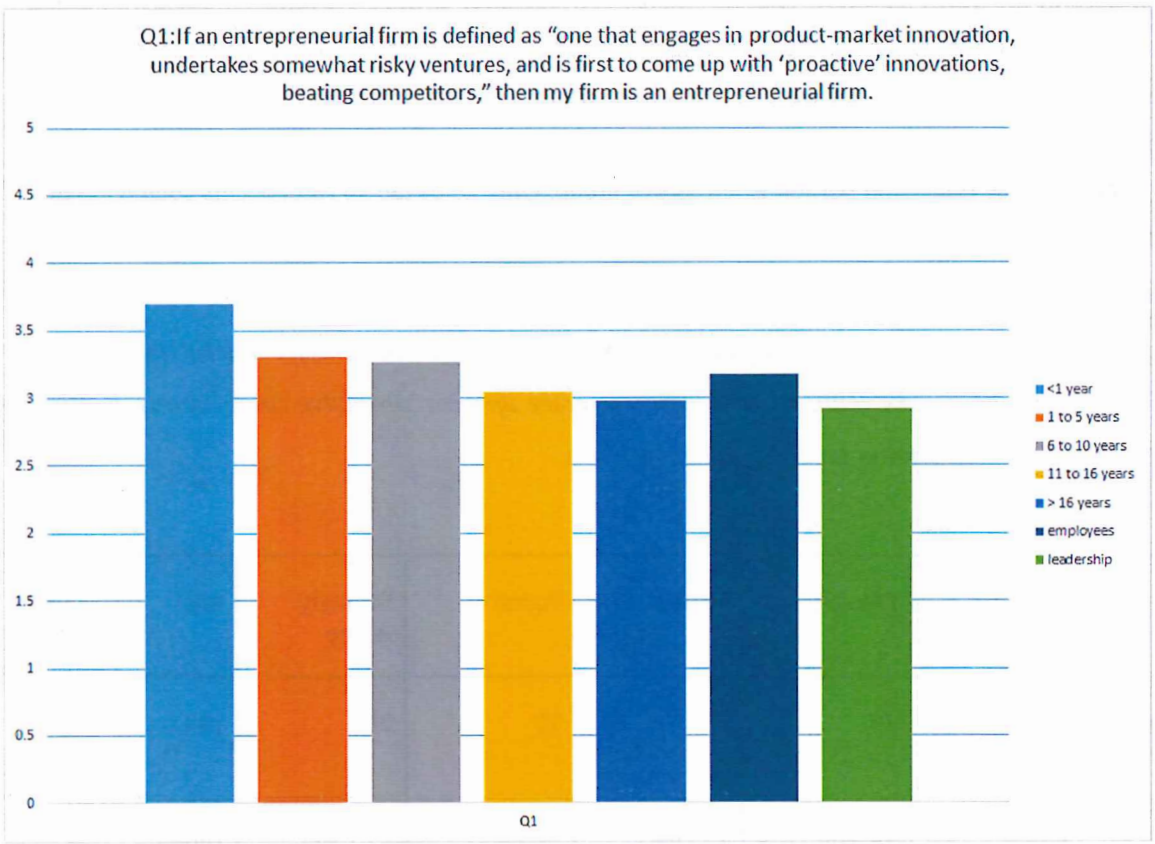

Figure 3. Question 1: Average Response by Years of Service

Q2: My firm characteristically exhibits high levels of risk taking, innovativeness, and proactiveness.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	total
engineer raw count	29	68	50	43	9	199
engineer %	14.57%	34.17%	25.13%	21.61%	4.52%	100%
leader raw count	5	16	6	8	1	36
leader %	13.9%	44.4%	16.7%	22.2%	2.8%	100%

Average engineer response: 2.68, Standard deviation: 1.09

Average leader response: 2.56, Standard deviation 1.08

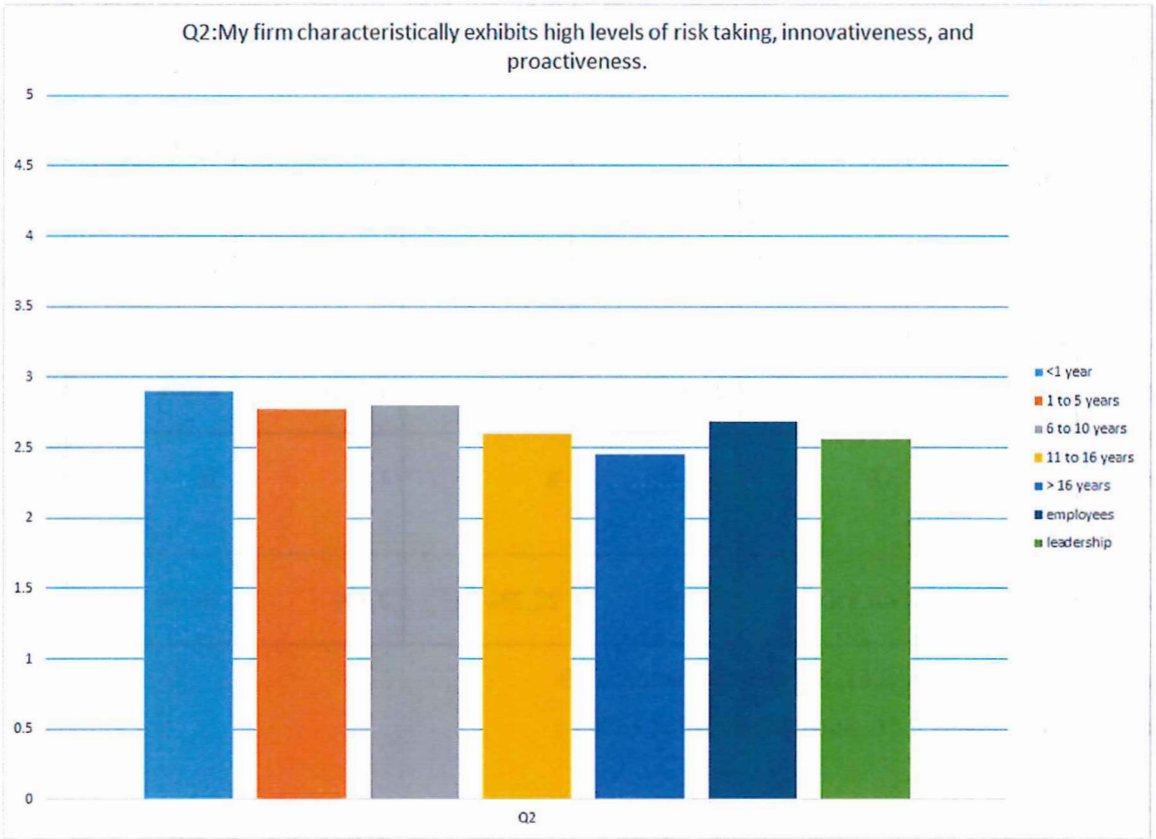

Figure 4. Question 2: Average Response by Years of Service

Q3: My firm often takes calculated risks by pursuing innovative initiatives before potential rivals recognize the opportunities at which our initiatives are targeted.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	total
engineer raw count	15	46	48	71	16	196
engineer %	7.65%	23.47%	24.49%	36.22%	8.16%	100%
leader raw count	1	12	9	14	0	36
leader %	2.8%	33.3%	25%	38.9%	0%	100%

Average engineer response: 3.13, Standard deviation: 1.09

Average leader response: 3.0, Standard deviation .926

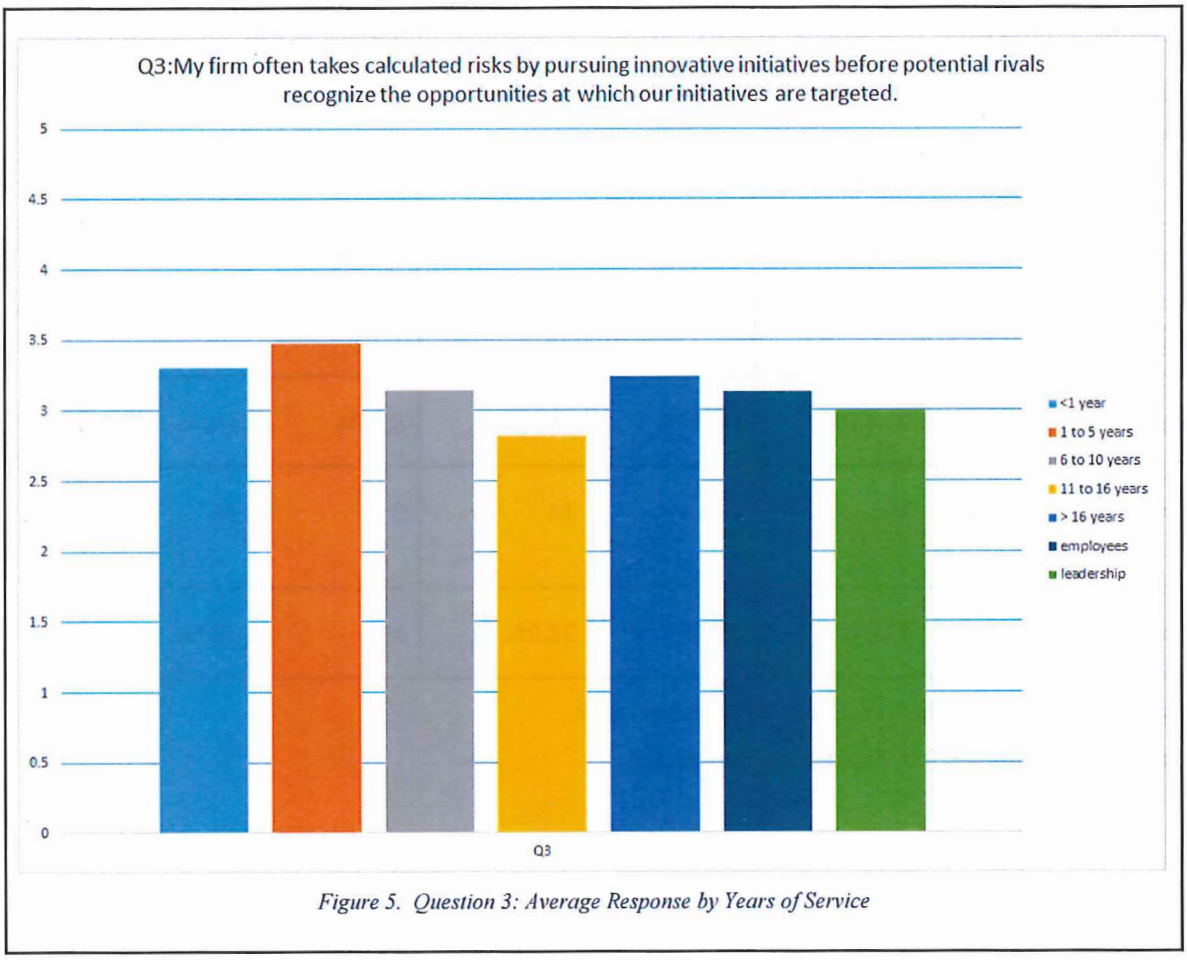

Figure 5. Question 3: Average Response by Years of Service

Q4: Risk taking, innovativeness, and proactiveness are equally inherent to my firm's overall business orientation.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	total
engineer raw count	16	77	53	43	9	198
engineer %	8.08%	38.89%	26.77%	21.72%	4.55%	100%
engineer raw count	6	15	7	7	1	36
leader %	16.7%	41.7%	19.4%	19.4%	2.8%	100%

Average engineer response: 2.76, Standard deviation: 1.02

Average leader response: 2.5, Standard deviation 1.08

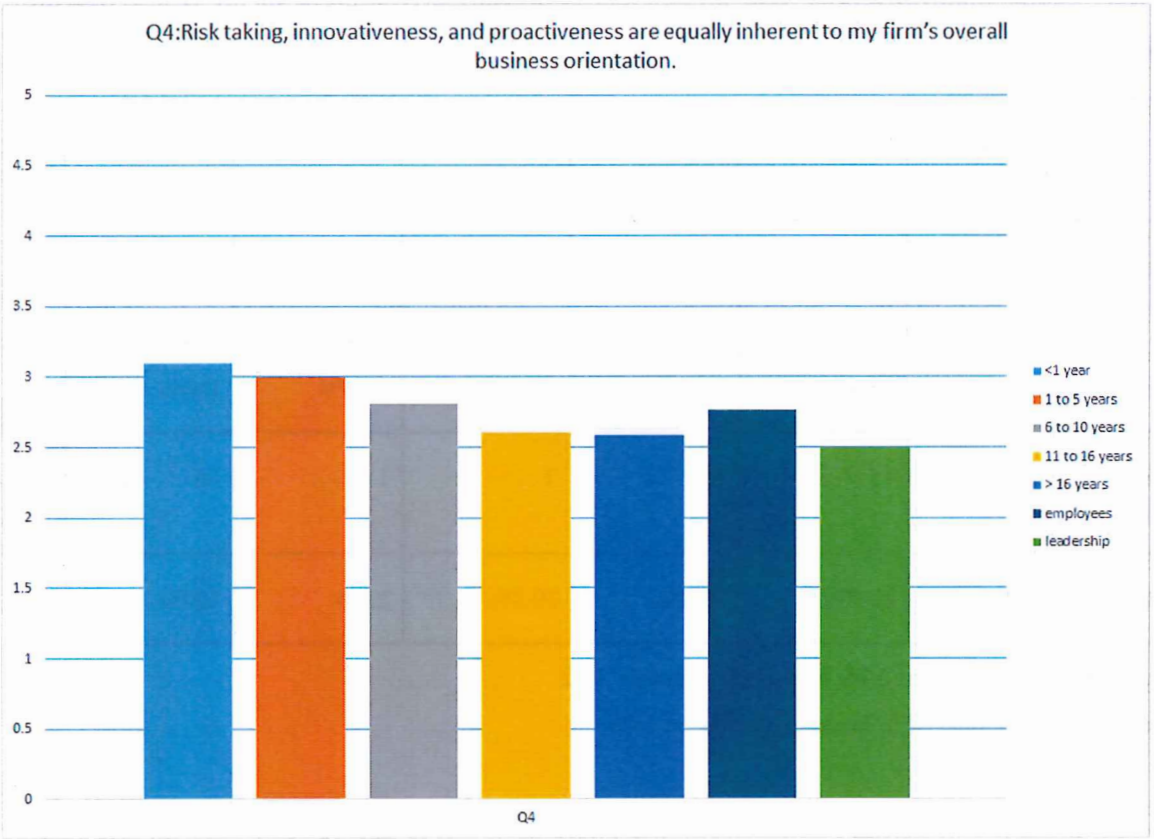

Figure 6. Question 4: Average Response by Years of Service

Q5: The innovative initiatives pursued/funded by my firm are often somewhat risky and industry leading (i.e., chosen in advance of other firms' potentially similar initiatives).

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	total
engineer raw count	19	52	58	63	6	198
engineer %	9.60%	26.26%	29.29%	31.82%	3.03%	100%
leader raw count	2	12	8	13	1	36
leader %	5.6%	33.3%	22.2%	36.1%	2.8%	100%

Average engineer response: 2.92, Standard deviation: 1.04
Average leader response: 2.97, Standard deviation 1.02

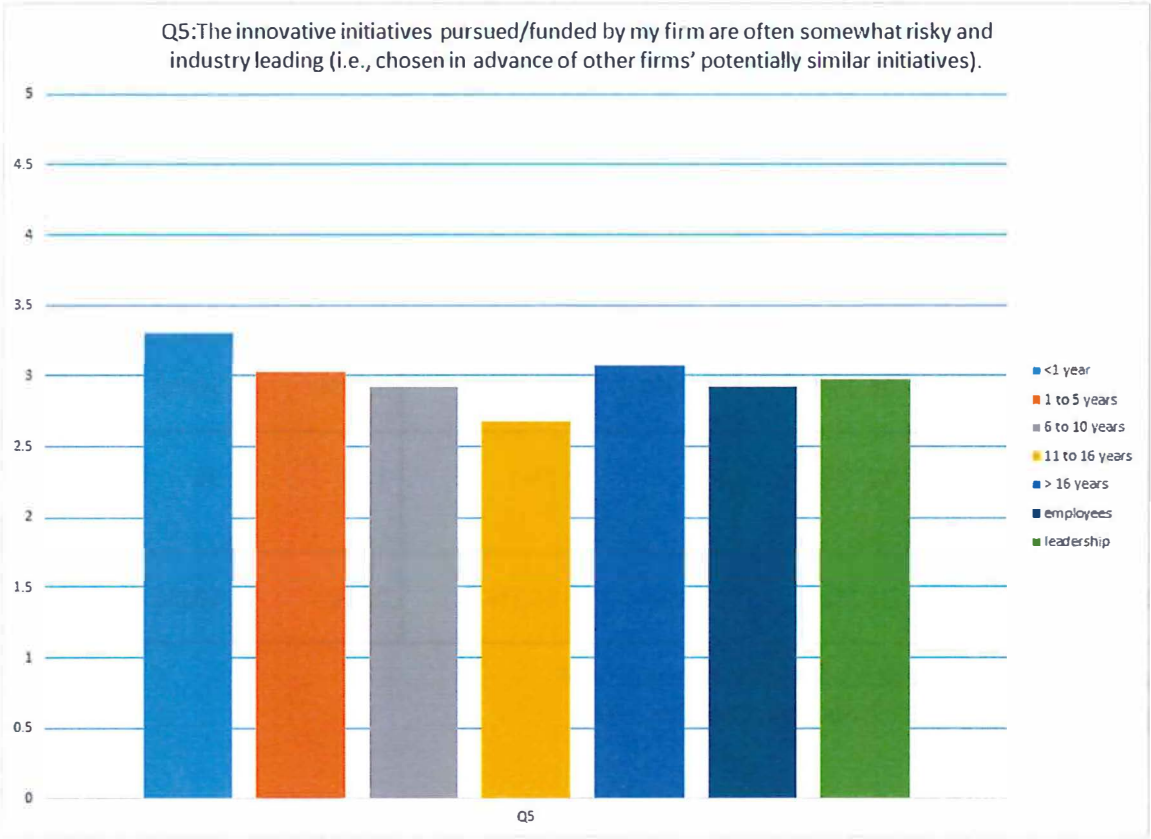

Figure 7. Question 5:Average Response by Years of Service

Q6: My firm concurrently manifests risk taking, innovativeness, and proactiveness.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	total
engineer raw count	18	71	55	50	4	198
engineer %	9.09%	35.86%	27.78%	25.25%	2.02%	100%
engineer raw count	3	19	7	7	0	36
leader %	8.3%	52.8%	19.4%	19.4%	0	100%

Average engineer response: 2.76, Standard deviation: .996
Average leader response: 2.50, Standard deviation .906

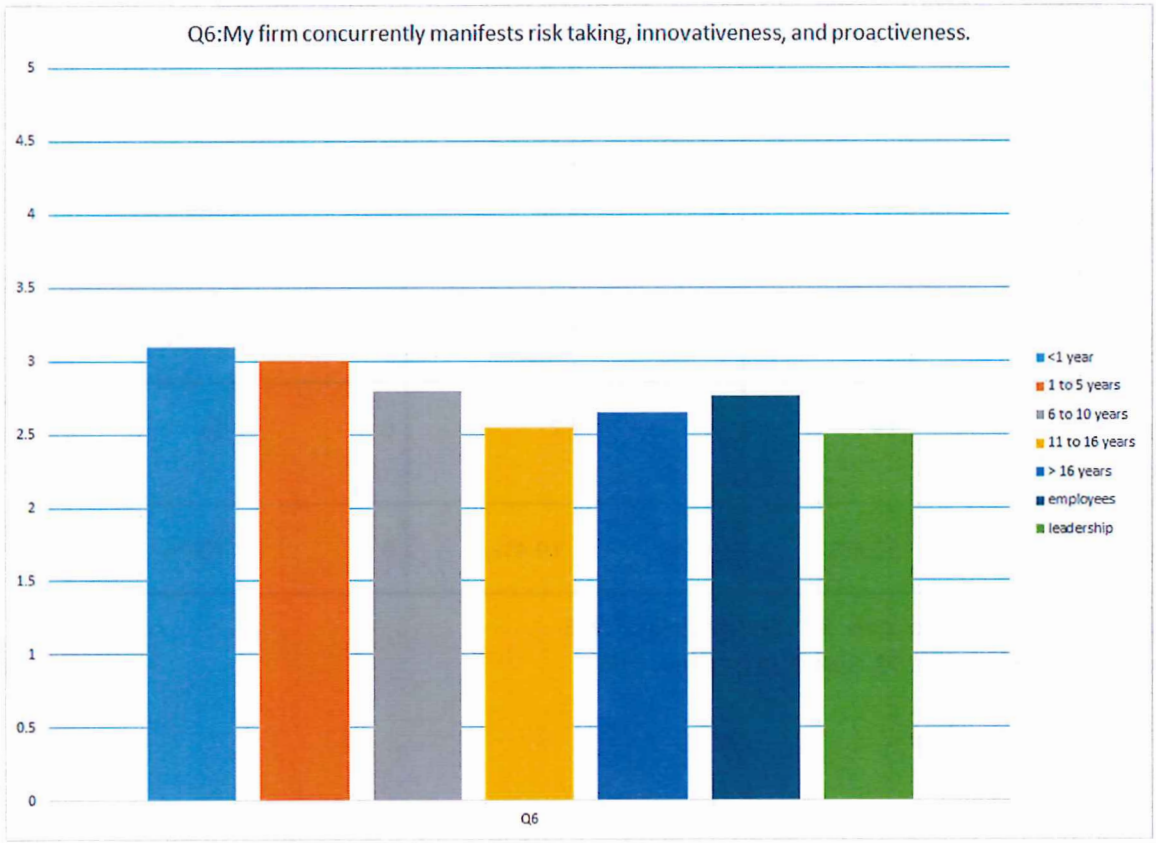

Figure 8. Question: Average Response by Years of Service

Q7: My firm often pre-empts its rivals by being an early leader with innovations whose successful outcomes cannot be assured.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	total
engineer raw count	20	36	61	68	12	197
engineer %	10.15%	18.27%	30.96%	34.52%	6.09%	100%
leader raw count	2	10	13	11	0	36
leader %	5.6%	27.8%	36.1%	30.6%	0%	100%

Average engineer response: 3.07, Standard deviation: 1.08
Average leader response: 2.92, Standard deviation .906

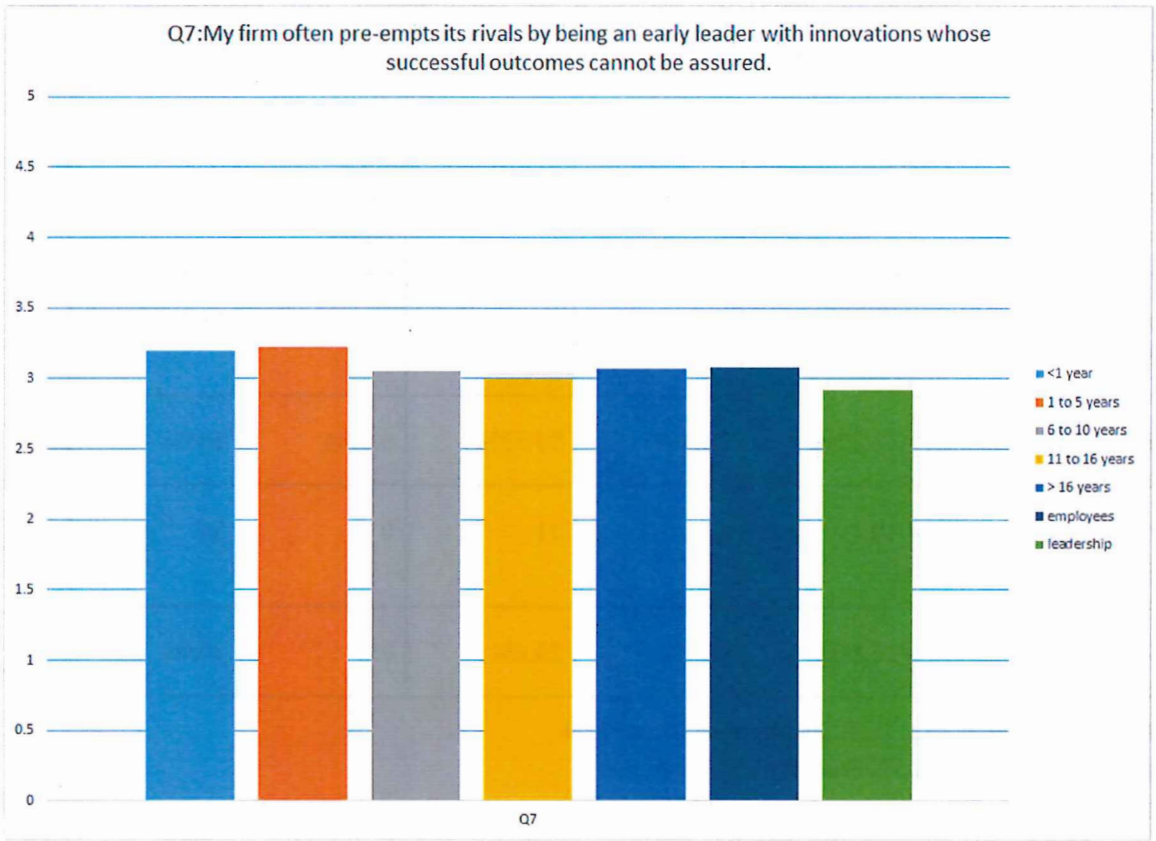

Figure 9. Question 7: Average Response by Years of Service

Q8: In general, my firm is on the cutting edge when it comes to exploiting entrepreneurial opportunities because of our desire and demonstrated ability to embrace novel (and often risky) innovative initiatives ahead of our rivals.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	total
engineer raw count	32	63	48	44	11	198
engineer %	16.16%	31.82%	24.24%	22.22%	5.56%	100%
leader raw count	4	15	8	8	1	36
leader %	11.1%	41.7%	22.2%	22.2%	2.8%	100%

Average engineer response: 2.69, Standard deviation: 1.14
Average leader response: 2.64, Standard deviation 1.05

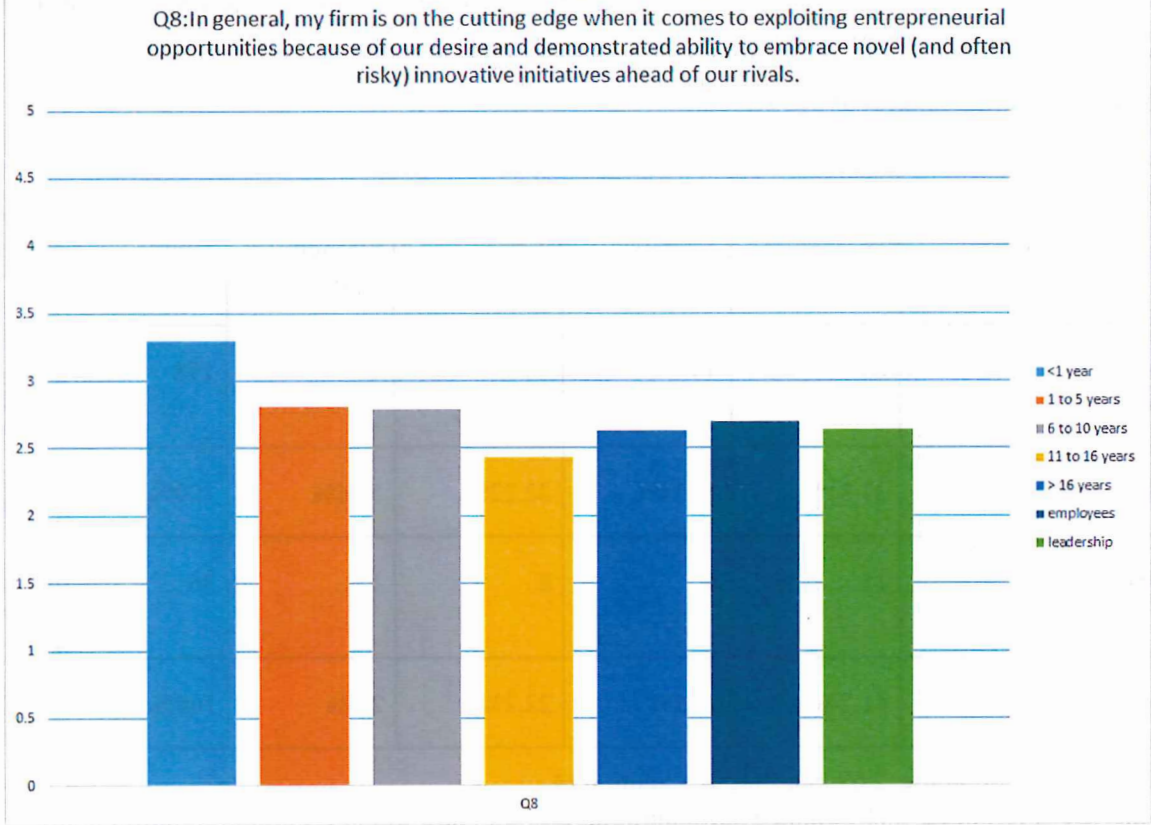

Figure 10. Question 8: Average Response by Years of Service

Senior Leadership Results

The following topic areas are the results of the Senior Leadership Questions (SLQs).

Strategy

SLQ9: How do you rate the firm on its ability to effectively execute strategy? (1-5 scale, 1 weak, 5 strong)

	Poor (1)	Below Average (2)	Average (3)	Above Average (4)	Outstanding (5)	Total
raw count	2	13	17	3	1	36
%	5.56%	36.11%	47.22%	8.33%	2.78%	100%

Average: 2.67
Standard Deviation: 0.83

SLQ10: How often do you see the strategy being applied and executed in daily operations? (1-5 scale, 1 never, 5 always)

	Never (1)	(2)	(3)	(4)	Always (5)	Total
raw count	2	13	15	6	0	36
%	5.56%	36.11%	41.67%	16.67%	0%	100%

Average: 2.69
Standard Deviation: 0.82

SLQ11: Do you understand the firm's strategy?

	Yes	No	Somewhat	Don't Care	Total
raw count	18	2	16	0	36
%	50%	5.56%	44.44%	0%	100%

Resource Moves

Senior Leadership questions (SLQ) 13 to 24 dealt with the movement of people between projects and how that relates to the strategic goals set forth in the Strategic Growth Plan. Of the 37 leaders, 24 completed this portion of the survey. Further, two were thrown out for reporting overseeing 100 and 250 projects with the mean without those respondents being 16 projects. Another respondent's data point was thrown out for reporting more projects affected by moves than total projects overseen, leaving 21 respondents.

SLQ13: During that time period, how many projects have you overseen?

# of Respondents	# of Projects
21	337

SLQ14: How many of these projects were cancelled to transfer resources to a higher priority project?

# of Cancelled Projects	% of Total Projects	# of "Don't Know" Responses
43	34.9%	0

SLQ15: How many of the cancelled projects were part of the strategic plan?

Four of the respondents responded "Don't Know." Excluding their reported cancelled projects yields:

# of Cancelled Projects (strategic)	% of Cancelled Projects	% of Total Projects
12	44.4%	3.6%

Using the above percentage as an assumption about the projects for those reporting "Don't Know" yields an additional 7 cancelled projects which were part of the strategic plan. Those values are then used with the result above to yield:

# of Cancelled Projects (strategic, assuming don't know)	% of Cancelled Projects	% of Total Projects
19	44.2%	5.6%

SLQ16: How many of the cancelled projects were started up again at a later date?

One of the respondents answered "Don't Know". Excluding that response about cancelled projects from

the total yields:

# of Restarted Projects	% of Cancelled Projects
15	40.5%

Assuming the same percentage listed above applies to the "Don't Know" projects yields:

# of Restarted Projects	% of Cancelled Projects
17	39.5%

SLQ17: How many of these projects were not cancelled but had staff moved off to a higher priority project?

Four of the respondents selected "Don't Know." Excluding their projects from the total yields:

# of Downsized Projects	% of Total Projects
54	24%

Assuming the same percentage applies to those responding "Don't Know" yields:

# of Downsized Projects	% of Total Projects
81	24%

SLQ18: How many of the downsized projects were part of the strategic plan?

Seven respondents replied "Don't Know" (includes those that replied don't know to SLQ17). Excluding their projects yields:

# of Downsized Projects (strategic)	% of Downsized Projects	% of Total Projects
23	60.5%	6.8%

Assuming the same percentage applies to those responding "Don't Know" yields (includes assumption from SLQ17 results):

# of Downsized Projects (strategic)	% of Downsized Projects	% of Total Projects
43	53.1%	12.8%

SLQ19: How many of the downsized projects completed on time?

# of Downsized Projects Completed On Time	% of Downsized Projects
3	5.56%

SLQ20: How many of the projects were increased by pulling in resources from other projects?

# of Upsized Projects	% of Total Projects
60	17.8%

SLQ21: How many of the increased projects were part of the strategic plan?

Six respondents replied "Don't Know." Excluding their projects yields:

# of Upsized Projects (strategic)	% of Upsized Projects	% of Total Projects
35	97.2%	10.1%

Assuming the same percentage, including the estimates for the "Don't Know" answers yields:

# of Upsized Projects (strategic)	% of Upsized Projects	% of Total Projects
58	96.7%	17.2%

SLQ22: Of these increased projects, how many were completed on time?

Five respondents replied "Don't Know." Excluding their projects yields:

# of Upsized Projects (on time)	% of Upsized Projects
10	19.2%

Assuming the same percentage applies to those responding "Don't Know" yields:

# of Upsized Projects (on time)	% of Upsized Projects
12	20%

SLQ23: Of these increased projects, how many met the financial expectations (orders, revenue, etc.)?

# of Upsized Projects (met expectations)	% of Upsized Projects
28	46.7%

SLQ24: How many projects have had significant scope change (ex: large design change after months of engineering effort)?

# of Significant Scope Change	% of Total Projects
103	30.6%

Knowledge Transfers

SLQ25: When people moved off of a project, how much time passed between their finding out they'd be changing positions and their starting the new one full-time?

# of Respondents	Average (days)
25	8.4

SLQ26: How well do you feel the reason for these project changes are communicated to employees?

	Poor (1)	Below Average (2)	Average (3)	Above Average (4)	Outstanding (5)	Total
raw count	4	10	11	1	0	26
%	15.38%	36.46%	42.31%	3.85%	0%	100%

Average: 2.35
Standard Deviation: .78

SLQ27: How well do you think documentation and knowledge capture (of requirements/design decisions/lessons learned) happened on these projects?

	Poor (1)	Below	Average (3)	Above	Outstanding	Total

		Average (2)		Average (4)	(5)	
raw count	8	12	5	1	0	26
%	30.77%	46.15%	19.23%	3.85%	0%	100%

Average: 1.96
Standard Deviation: .81

SLQ28: Was time allotted for clean handoff and/or documentation?

	Yes	No	Somewhat	Don't Know	Total
raw count	2	14	6	0	22
%	9.09%	63.64%	27.27%	0%	100%

63.64% of respondents thought that sufficient time was not allotted for handoff and documentation when they were transferred from one project to another.

SLQ29: Does training/standard practice exist on knowledge capture/hand offs?

	Yes	No	Somewhat	Don't Know	Total
raw count	0	14	8	0	22

%	0%	63.64%	36.36%	0%	100%

SLQ28 and SLQ29 are related. 63.64% of respondents thought that sufficient time was not allotted for handoff and documentation when they were transferred from one project to another. Zero percent of respondents said that training/standard practice exists on knowledge capture/handoffs and only 2 respondents out of 22 (9.09%) said that they had sufficient time to document and hand off when they were transferred. There are multiple responses to this data.

Perhaps if a standard practice existed for how to capture the results of decisions throughout the project and was regularly used, then it would be less of the case that project knowledge exists only as undocumented tribal knowledge. It may help if a template existed for what an employee should capture before moving off of a project -or a list of questions that should be filled out by the exiting employee documenting the point they are at in their current efforts, basic rationale behind recent important decisions, and drive locations where important project documents are saved.

SLQ30: Who planned training or team on-boarding/ramp up for new members of the project team?

Role	Count	% Response
Manager	6	27.3%
Lead	8	36.4%
Manager and Lead	5	22.7%
Standardized procedures and	1	4.5%

shadowing		
Engineers	1	4.5%
Nobody	1	4.5%

SLQ31: What were the main challenges in providing training to new members of the project team?

There were 22 responses to this open question. Highlighted categories of responses are in the table below.

Category	# Responses	% Response
Insufficient Time/Schedule	12	54.5%
Not Budgeted	6	27.3%
Distraction to senior engineers	4	18.2%

Over half of respondents listed insufficient time/schedule as the main challenge standing in the way of providing training to new team members. The next largest group of respondents listed that it was "not budgeted for." When a project is behind schedule, "adding more people" is a risk management technique to be considered. However, if those new people are untrained on the needed task and solid training documentation is not available, this addition may slow down the employees already engaged on the task, as they have to pause their work to bring new people -who may not even have the needed background for the tasks- up to speed. This actually hinders, rather than helps, a project's schedule.

Adding people can be a help, but it must either be early enough in the project's schedule that the benefit of the new employees output outweighs the loss of time and money needed to train them and bring them up to speed or the new employees who are added must be enough of subject matter experts that they require very little direction to create real gains for the project. The decision to add people to a project that is slipping schedule should be carefully considered and the input of the members of the project team should be included in the discussion. The quotes below shine a light on the thoughts of respondents.

Quotes:

"The new people that are given to our team when we need people are the bottom of the barrel people from other teams. So not only do you have to deal with a normal learning curve you are having to work with lower quality engineers."

"[Training of new team members is] Unfunded by both the program/project and not funded by [overhead budget]. Not recognized as a 'value added' cost."

"Learning curve for people new to our team is several months. Throwing new people on a project to save it late in the game (which is what the company does) makes it worse. It does not help get the project done on time and creates a negative atmosphere on the team for the current and new team members."

SLQ32: Given the same set of resources (time, staff, budget), what would you do differently?

Highlighted quotes in the following table:

Estimate more time for training and fight to keep that $ in the budget
Make sure that all levels of management agreed about the significance of the project and the need to fund it. This is difficult in an era of change. You could have that consensus and then new folks come in and don't agree. Building a rock solid business case first could help a project stand firm against the

winds of change. We too frequently initiate projects based on the whims of product management.
Get better communication between managers. Matrix seems to filter before it gets to the engineer. "Guarantee it doesn't"
Need to get people excited about how they tie into the company strategy
Create more realistic schedules that do not always over task the engineering team.
View a methodical onboarding and periodic refresher training to pay off in the long run
Make sure scope and budget are clearly aligned, with buy-in at all levels. Then communicate the frequent scope changes in terms of budget/schedule/performance/cost, and again get buy-in at all levels.
Better planning and estimating, limit scope creep, give time for onboarding and ensure handoff/release is in the plan and executed properly.
plan time for cross-training on complex features
Lock requirements down early
train staff in groups while more senior engineers flush out design
Slow ramp up time to allow senior personnel to design and plan, dedicate staff to execute and do not start / stop or otherwise throttle the project beyond original project constraints.
reduce scope so that a realistic schedule and project plan can be put in place
Elevate need for organizational assistance

I think the Team would have been happier if some of this work could have been done as part of the project. We worked a lot of OT as it was, adding the training was appreciated but was quite a burden for people with outside interests or families.
It was better to not be given new team members at the end of an already in trouble project unless those people are top notch engineers. So the only things that could be done differently is to not have accepted the help or been given people that could come and contribute immediately.

Decision Making

SLQ33: What measures are used to track the performance of the business unit?

	Financial	Non-Financial	Both	Total
raw count	11	1	10	22
%	50%	4.55%	45.45%	100%

SLQ34: At what level are resource shifts typically made (Executive, Senior Manager, Manager) or are the decisions made in a cross-functional committee?

	Executive	Senior Management	Middle Management	Cross-Functional Committee	Total
raw count	11	10	1	0	22
%	50%	45.45%	4.55%	0%	100%

According to respondents, resource shift decisions are typically made at a higher level of management. This makes sense, however, as much as there can be challenges with communication down the management chain, there can also be challenges with communication up the management chain, meaning that managers making the decision to add more resources to a project may not have a clear vision of the environment on that project's team.

SLQ35: Is incentive compensation based on objective or subjective criteria?

	Purely Objective (1)	Slightly More Objective (2)	50/50 (3)	Slightly More Subjective (4)	Purely Subjective (5)	Total
raw count	2	5	6	4	5	22
%	9.09%	22.73%	27.27%	18.18%	22.73%	100%

Average: 3.23
Standard Deviation: 1.28

Responses were split on whether incentive compensation was based on objective or subject criteria. This may mean that incentive compensation varied for different roles or projects or that there is not clear communication on this topic.

Engineering Results

The following topic areas are the results of the Engineering Questions (EQs).

Strategy

EQ3-EQ9 focused on strategy and how it is understood and applied throughout the engineering organization.

EQ3: Do you know the five pillars of the firm's strategy? (Or easily know where to find them?)

	Yes	No	Somewhat	Don't care to know	Total
raw count	68	64	55	12	199
%	34.2%	32.2%	27.6%	6.0%	100%

EQ4: Do you understand the firm's strategy?

	Yes	No	Somewhat	Don't care to know	Total
raw count	48	40	108	3	199
%	24.1%	20.1%	54.3%	1.5%	100%

EQ5: Do you know our core competencies? (Or easily know where to find them?)

	Yes	No	Somewhat	Don't care to know	Total
raw count	68	64	55	12	199
%	34.2%	32.2%	27.6%	6.0%	100%

EQ6: Do you know how the work you are doing connects to the firm's strategy or core competencies?

	Yes	No	Somewhat	Other (please specify)	Total
raw count	101	27	69	2	199
%	50.8%	13.6%	34.7%	1.0%	100%

EQ7: Of the projects you've been involved with, how many were part of the strategic plan for the company?

	None (1)	Less than half (2)	50/50 (3)	More than half (4)	All (5)	Total
raw count	8	30	43	88	30	199

%	4.02%	15.08%	21.61%	44.22%	15.08%	100%

Rating Average: 3.51

EQ8: How would you rate your firm on its ability to effectively execute strategy?

	Weak (1)	Below Average (2)	Average (3)	Above Average(4)	Strong (5)	Total
raw count	17	41	103	35	3	199
%	8.54%	20.6%	51.76%	17.59%	1.51%	100%

Rating Average: 2.83

EQ9: How often do you see the strategy being applied and executed in daily operations?

	Never (1)	Less than half the time (2)	50/50 (3)	More than half the time (4)	Very Often (5)	Total
raw count	9	63	71	51	5	199
%	4.52%	31.66%	35.68%	25.63%	2.51%	100%

Rating Average: 2.90

Employee Engagement

EQ10: How many of the projects you have been involved on were cancelled to transfer resources to a higher priority project?

Total Number of Responses	195
Number of quantitative Responses	154
Average Number of Project Cancelled	1.29
Min	0
Max	10
Median Number of Projects Cancelled	1
Std dev	1.67

EQ11: How many projects were not cancelled but you were transferred to a higher priority project?

Total Number of Responses	195
Number of quantitative Responses	137
Average Number of Project Cancelled	1.54
Min	0
Max	15
Median Number of Projects Cancelled	1
Std dev	2.28

EQ12: If you have been moved off a project, do you feel your career was helped or hurt by these moves?

	Helped	Hurt	Neither	Never been moved off a project	Total
raw count	26	36	81	52	195
%	13.3%	18.5%	41.5%	26.7%	100%

Respondents most commonly answered that their careers were sometimes helped and sometimes hurt by moves/that results were mixed.

Highlighted quotes in the following table:

Both. My career hasn't been hurt, the company leadership looks indecisive. What I do also involves jumping from one project to another to define pinout to feed others which is important.
Depends, my career has been long enough that I've experienced both. I sense there is often frustration that the moves are to satisfy immediate corporate needs and not employee career goals.

EQ13: If you have been moved off a project, do you feel the firm (and overall completion of priority projects) was helped or hurt by these moves?

	Helped	Hurt	Neither	Never been moved off a	Total

				project	
raw count	32	53	59	51	195
%	16.4%	27.2%	30.3%	26.2%	100%

Most respondents gave an answer of "mixed" or "both." Whether the firm was helped or hurt depended on which project was more valuable to the company, which was not always clear to the respondents, outside of the fact that they had been moved off of one and onto another, which suggested the priority of the company.

Highlighted quotes in the following table:

Continue to believe the firm should focus on building/maintaining teams and applying teams to projects.
Hard to quantify, but the abrupt nature of stopping these projects is the real problem, sudden changes causes everyone to lose momentum, energy and focus.
It helped the short term goals, but hurt long term ones.

Optional: Please share any thoughts you may have on how the firm can better align decisions to strategy, and how best to communicate these ideas to decision makers. Your honest feedback is extremely helpful.

Highlighted quotes in the following table:

Continue open dialogs on how the strategic plans are evolving from year to year.
Any 'strategy' will fail if the moral [sic] of the employees is low.
You can't align decisions until you have a strategy, not just vague bullet points VPs give lip service to. Start with a clear long term vision that's measureable, from that stems one or more long term strategies (decade long time horizons), from those flow tactics (shorter term 1-3 year plans). You won't succeed when your total vision does not extend beyond the duration of a typical product life cycle.
In my business unit, there have been profound inconsistencies or failures to establish and execute a clear strategy. This has been reinforced by the inability to obtain and keep a president for the business unit, as well as appropriate senior staff for engineering and product management.
stop making "knee jerk" reactions based on short term financial result
I believe the firm does have an execution strategy, but it is not part of the "pulse" of the organization at the level of the engineers doing the work. We are focused on our deliverables, and our limited contact with upper management rarely includes articulation of the broad strategy of the company.
As a software engineer, working at [the firm] can be frustrating especially when being shifted around on various projects due to stove-pipe mentality on the projects that leads to entirely different sets of tools for development being used in the company. As soon as you start to get

familiar with one set of tools you are ripped off the project and put onto another one with another sets of entirely different tools and processes. In the last 2 companies I worked for... there was one and only one set of archival, bug reporting, tracking tools used company wide and that was the ClearCase/ClearQuest system.
Engineering is often at the tail end of news/decisions and thus the change always appears abrupt when it may have always been a contingency plan.
Aligning re-allocation of resources to individuals' current passion/connectedness to the project may help. That is, moving those who are engaged in the project to one they do not feel strongly about will likely decrease effort. Can we align personal desire to meet strategic goals to the projects aligned with those goals?
I don't know enough about how this happens at [the firm] to be able to provide an opinion on this. I don't know who makes decisions, nor do I know what information they base the decisions on. Do you?
Shared so many thoughts so many times I feel like Sisyphus. Don't have the energy to do it again. Good luck with your project.
At [my division], it is hard to execute on innovating and changing the market when you are not funded to take on the riskier projects. If it is always minimally funded we will always be playing catch-up in the market

EQ14: How well do you feel the reason for these project changes were communicated to you? (1-5 scale, 1 Poor, 5 Excellent)

	Poor (1)	Fair (2)	Average (3)	Well (4)	Excellent (5)	Total
raw count	35	32	75	47	6	195
%	17.95%	16.41%	24.10%	3.08%	15.08%	100%

EQ15: How many projects have you been on that have had significant scope change (ex: large design change after months of engineering effort)?

Total Number of Responses	195
Number of quantitative Responses	123
Average Number of Project Cancelled	1.75
Min	0
Max	10
Median Number of Projects Cancelled	1
Std dev	1.83

EQ16: How well do you think documentation and knowledge capture (of requirements/design decisions/lessons learned) happened on these projects? (1-5 scale, 1 poor, 5 excellent)

	Poor (1)	Below Average (2)	Average (3)	Above Average(4)	Excellent (5)	Total
raw count	30	61	85	17	2	195
%	15.38 %	31.28%	43.59%	8.72%	1.03%	100%

Average: 2.49

EQ17: I feel loyal to my... (Project Team, Discipline Team, Neither, Other)

	Project Team	Discipline Team	Neither	Other (please specify)	Total
raw count	101	57	15	18	191
%	52.9 %	29.8	7.9	9.4	100%

Chapter 6 – Conclusions

Entrepreneurial Orientation

While there was a slightly more positive impression of the Entrepreneurial Orientation of the company by the engineers than the leadership, overall the results were neutral to slightly disagree, indicating that the firm takes some risks and does some innovation. The average response of the engineers was 2.9 and that of the leadership was 2.75. The two groups were also very consistent, with only an average difference between their answers to each question of 0.15. Answers ranged from 2.68 to 3.17 for the engineers and 2.5 to 3.0 for the leadership.

The more favorable responses were for the questions revolving around beating rivals to market. These responses tended toward neutral or slightly positive in the case of the engineers. The remaining questions revolving around "risk taking, innovativeness and proactiveness" scored the lowest, being around 2.5 for the leadership and 2.8 for the engineers. These results make sense when compared against the typical strategy of bidding on a government contract and then if losing the bid, funding the project with internal R&D funds to produce the product anyway before the program of record can complete (sometimes by years). The company is taking risks to fund and produce a product before its rivals can, however, since it is a product the customer has already specified and requested, the firm is not being significantly innovative or proactive.

It is interesting to also note that in most cases, the responses of the engineers tended to become more negative over time. With the exception of the first two questions, however, the negative trend abruptly goes positive with the > 16 year veterans. This could be due to a couple of factors. Product life cycles tend to be fairly long (~10 years or more). If engineers are working on the same product for several years, they may feel that innovation is stifled and it isn't until that product hits end-of-life that they are put on a new product that is newer, causing an uptick in the response. The other possibility is that more senior engineers in the > 16 year category are more involved with advanced development or are involved with more architectural decisions, giving them the opportunity to be more innovative. In either case, this negative trend may be something to watch out for as the 11 to 16 year group tended to be the most pessimistic group, including both engineers and leadership. On average this group scored each of the

questions .19 below the engineer average and .04 below the leadership. This may be an opportunity for future study as it may be that this group is in danger of leaving the company if their expectations for innovativeness is not being met. Since these veteran engineers hold a lot of corporate knowledge, it would cost the company a great deal to find and train replacements, so understanding why this negative trend exists would be valuable.

Conclusion:

The neutral to slightly negative entrepreneurial orientation is not in itself a cause for concern, especially when so much of that rating seems to come from the proactive nature of the responses. Being a fast follower is a viable market strategy. However, the trend in more negative responses among the more veteran engineers is something that should be investigated to save some potentially large costs in hiring and training replacements for these valuable employees. If this trend is due to the long life cycles of products, then a simple solution may be to encourage more movement between product groups so that the engineers get exposure to more of what is going on.

Strategy

There is a fairly strong Pearson correlation (r=0.686) between leadership's rating of the company's ability to effectively execute strategy vs. how often they see strategy being executed in daily operations. As leadership ranked both the ability to execute and frequency of strategy fairly low (2.67 and 2.69, respectively), this is a strong indicator that the company's strategy is not being followed. There is very little correlation (r=0.190) between the effective execution and the understanding of the strategy as well as little correlation (r=0.223) between the application of strategy and the understanding. With only half of the respondents indicating they understood the firm's strategy, this is a cause for concern. If the leadership does not have a firm grasp of what the strategy is, very likely they will not make decisions that align with the desired outcomes. Leadership is also a critical link in communicating the strategy to the engineer base, which will cause further communication issues if the leadership does not have a firm understanding themselves.

The communication flow down of strategy from leadership to engineering does not appear to be

in place within the firm. With just over 50 % of the respondents indicating that they have somewhat of an understanding of the firm's strategy, there is very little correlation (r=0.125) between the number of years an engineer has worked and the understanding of the firm's strategy. This also holds for the understanding of the company's five pillars (r=0.154).

No correlation was seen (r=0.064) between the number of projects overseen and how well the respondent rated the firm on strategy. A slight positive correlation (r=0.307) was seen between the percentage of respondents' cancelled projects that were part of the strategic plan and how they rated the firm on executing strategy.

A positive correlation was seen (r=0.528) between how well leaders felt the reasons for project changes were communicated to employees and how they rated the firm on execution of strategy. Leaders who felt that reasoning was well communicated to employees were more likely to say that the company executes strategy well.

Of projects which were increased by pulling in resources from other projects, survey respondents among leadership said that 18.6% of those increased projects were completed on time and 40% met the financial expectations (orders, revenue, etc.). There is a slight linear relationship (r= 0.37) between the respondents understanding how the work they are doing connects to the firm's strategy and how often they see the firm's strategy applied. This correlation is shown in the figure below. Respondents were grouped by how well they said that they understood how their work relates to strategy: understand (1), somewhat (2), and do not understand (3).

Because this relationship seems so slight, a two-tailed t-test was performed to verify if there is a statistically significant difference in the perception of seeing the strategy applied between those who say they understand how their work relates to strategy (3) and those who don't (1). An $\alpha<0.05$ is deemed to be statistically significant. We measure a p-value of 2.02E-6, indicating a statistically significant difference.

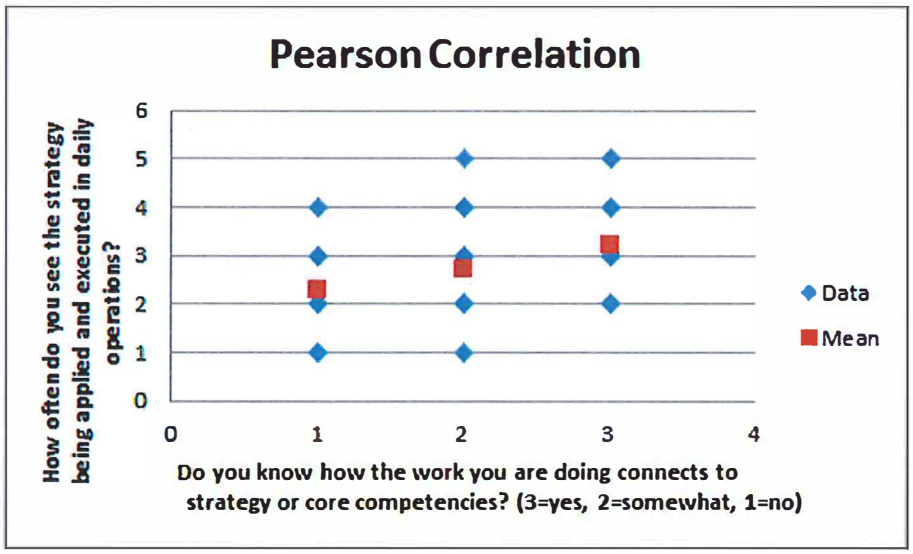

Figure 11. Correlation of understanding strategy and seeing it applied

Conclusion:

The connections between the firm's strategy and daily operations needs to be strengthened within the organization. The firm must create a framework for how the strategy is communicated to both the senior leadership and engineers, as the results show that in both groups there is not a strong understanding of how one's work relates to the firm's execution of strategy. When placing Kotter's (2013) framework for effective strategy execution, into the context of the firm, the key step missing between strategic planning and execution is the urgency process. Although our surveys did not address or measure urgency, the firm's execution of strategy could benefit from an urgency process as it would be a quantifiable and repeatable way to generate alignment and engagement with majority of the employees.

Resource Moves

The results of the questions around moving resources between projects indicate an area of improvement that could be made. 35% of the projects conducted were cancelled to move people to a higher priority project. Around 44% of these cancelled projects were part of the strategic plan (around 4%

of the total projects). This indicates a large number of projects being executed that are not part of the strategy. Further, 40% of the cancelled projects were later started up again. The costs to ramp down a project and then back up again, coupled with the poor handoffs/training indicated by the leadership respondents, means that a large amount of money is wasted during these resource moves. There is little correlation (r=0.199) that the restarted projects were part of the strategic plan, further reinforcing the negative view on strategic execution. Additionally, 24% of the projects had their staffing lowered to work on a higher priority project, 60% of which were part of the strategic plan (7%-13% of the total). 18% of the projects had staffing increases, with 97% of them being part of the strategic plan. In total, 77% of the surveyed projects were affected by some sort of resource shift, indicating a very volatile environment.

The large number of cancelled or slowed projects that were part of the strategic plan (11%-17% of the total projects) may be an indicator that the firm is avoiding creative destruction on existing products. Considering Kwon's thresholds for investment, perhaps the firm should evaluate the investment and exit thresholds before investing to help determine if those projects should even have been started. The large number of project changes may indicate increasing volatility in the firm's market which, as Kwon indicated, "induces the firm to invest earlier." (Kwon, 2008, p. xi) With nearly all of the increased projects being on the strategic plan, however, the problem may not be that tactical projects are stealing resources; rather the issue is an aggregate project planning deficiency where resource levels are not being distributed correctly among the projects. Certainly the large number of affected projects that were not part of the strategic plan indicates a large portion of projects that are being executed are not part of the strategic plan.

There is little indication that these moves are useful, with only 20% of the increased projects reporting an on time completion and less than 50% met financial expectations. Contrast this with only 6% of the downsized projects finishing on time indicates that overall projects are finishing late for little real benefit to the overall strategy.

Conclusion:

Too many projects are being executed concurrently, many of which are not part of the strategic plan. During the annual operating plan phase, resource loading should be performed across the projects, keeping in mind both headcount as well as skillset. Loading of the engineers needs to be kept in mind as

well, with queueing theory stating that an optimal loading being around 80% to run the most efficiently. Project filters need to determine if recommended projects meet the strategic goals of the company and projects should not be started if they do not match.

Knowledge Transfers

As stated in the literature review under Open Innovation, knowledge is a company resource that requires continuous input since the value of the knowledge deteriorates over time. This is especially true if the knowledge is lost outright due to lack of knowledge transfers when people are moved between projects. A number of respondees, when asked who was in charge of hand off, responded "no one," suggesting that within their group there was no standard plan for how to handle documentation when a team member was moved off the project. On average, respondents from leadership ranked the firm as "below average" for documentation and knowledge transfer, as well as indicating that insufficient time and training exists to perform knowledge captures and hand offs, this means a significant amount of time and money is wasted relearning what was done before. This applies to both projects affected by resources moves as well as follow-on projects that leverage the work done by a previous project.

Conclusion:

A) The firm must develop common procedures and training on how to do knowledge capture and hand offs.

B) The firm must budget time/resources to perform knowledge transfers during project execution.

Organization and Management Control Systems (MCS)

Transaction Cost Economics (TCE) advocates that the system of management controls should have the following attributes:

- A mix of financial and non-financial measures need to be used
- Decision rights should be push further down the hierarchy
- Incentive compensation should be subjectively based

According to the leadership survey, only 45% responded that both financial and non-financial measures are used, with 50% responding that purely financial measures are used. 50% also reported that resource shifts are typically made at the executive level and 45% at the senior management level. There is little correlation (r=0.207) between these two results. Lastly, incentive compensation seems to be a roughly 50/50 mix (average response of 3.23, standard deviation of 1.28). There is no correlation between decision level and incentive compensation (r=0.044) and only slightly positive between performance measures and incentive compensation (r=0.322). Of particular note is that only 23% of the respondents reported that purely subjective criteria was used and 18% said "slightly more subjective."

Conclusion:

While it appears that the firm is correctly making decisions in a hierarchy as Gersbach & Wehrspohn suggested, there are a number of improvements that need to be made to improve the firm's performance under an uncertain environment as postulated by TCE. First, it appears that measures are not consistent across the organization and need to have a higher mix of non-financial measures used. Second, decisions need to be pushed further down the hierarchy (or the hierarchy made more shallow) to give decision-makers the flexibility to respond quickly. Lastly, incentive compensation needs to be adjusted to be more subjectively based to compensate for dynamic changes. Use of a tool call the Balanced Scorecard Concept could be used to help provide that mix of financial measures and improve the incentive compensation interaction with strategy.

Chapter 7 – Future Work

The results of this capstone project provided insights into the alignment of strategy within leadership/management and engineering organizations. While many of the research areas discussed in the literature review were addressed in the survey results, some areas that could be assessed in future work include urgency, training, and entrepreneurial organization.

Urgency

One area for additional study is measuring the urgency throughout a firm. Chapter 2 discussed the importance of an urgency process and communication plan in the firm's execution of strategy. Our study did not explicitly quantify urgency within the firm. Further study could be conducted within the firm to understand if there is an urgency process and a method to quantifying it to generate more alignment within the firm. In addition to measuring this urgency, a better understanding of the firm's communication plan can also be investigated. The results of our survey pointed to a lack of understanding of the firm's strategy at both the management and engineering levels. Investigating the communication plan between all levels has the potential to highlight additional insights for the firm, which could help to provide better communication and connection with the strategy.

Training

This survey asked if standard training existed for knowledge transfer as team members entered and exited a project and also asked who on the project team was in charge of training. Current training at the firm could be further described at the firm and best practices could be investigated.

By fully staffing, or overstaffing projects that are aligned with strategy, multiple people can work on the same aspect of a project. This means that when one team members leaves the project for whatever reason they were not the only keeper of the tribal knowledge relating to their area on the team. Decisions could be reviewed briefly in daily stand up meetings. Team members could attempt to document the logic behind major design decisions in areas where they were not the lead technical contributor, so that the lead

could review and correct any misunderstandings; then at least two people within the team would understand each major decision. These or other methods could be used and measured to see if they led to improved performance and team morale. Further investigation into knowledge sharing can be addressed within future studies. Regardless of the method of inter-team training, it is clear that the initial project budget must reflect time for training and documentation.

Entrepreneurial Orientation (EO)

One potential area of study revolves around the negative trend observed with EO based on years of service within the firm. Finding the root cause of this trend and correlating that to employee satisfaction and turnover rates could potentially provide the firm with valuable data on retention. It would also be interesting to repeat this among several companies, allowing researchers to determine if decline in EO is a normal trend or is a flag for larger problems such as complacency in the marketplace. Determining if employees working on different products over the course of their career has an impact on their rating of EO would also be an interesting data point, allowing the firm to potentially put a solution in place, like rotational programs, to invigorate their employees.

This project could cover only a limited scope. The topics referenced in this section would be interesting areas of focus for further research on strategy and business decision making.

Bibliography

Borison, A. (2005). Real options analysis: where are the emperor's clothes? *Journal of Applied Corporate Finance, 17*(2), 17-31.

Bourgeois, L. J., III (1981). On the measurement of organizational slack. *Academy of Management Review*, 6(1),29–39.

Brickley, J. A., Smith, C. W., Zimmerman, J. L., Zhang, Z., & Wang, C. (1997). *Managerial economics and organizational architecture*: Irwin, Chicago.

Bridger, E. (2015). *Employee engagement*. [Books24x7 version] Available from http://common.books24x7.com.ezproxy.rit.edu/toc.aspx?bookid=68070.

Caesens, G., Stinglhamber, F. and Marmier, V. (2016), The curvilinear effect of work engagement on employees' turnover intentions. *International Journal of Psychology, 51*, 150–155. doi:10.1002/ijop.12131

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School.

CityBusiness, Guest Perspective. (2016). Why employee engagement should be key in your business plan. *New Orleans CityBusiness* http://neworleanscitybusiness.com/blog/2016/03/22/why-employee-engagement-should-be-key-in-your-business-plan/ Accessed 11 Nov. 2016.

Collins, D. J., & Montgomery, C. A. (2008). *Competing on resources* (pp. 1-14): Harvard Business School, Boston.

Covin, J. G., & Wales, W. J. (2012). The measurement of entrepreneurial orientation. *Entrepreneurship Theory and Practice*, *36*(4), 677-702.

Cox, S., Christen, M., Deletic, G., Fatimilehin, O. (2007). Technology management analysis for effictive implementation of change using the six facets model: Evidence from within a financial services company, *International Journal of Business Strategy*, *7*(1), 33-44.

Dierickx, I., & Cool, K. (1989). Asset stock accumulation and sustainability of competitive advantage. *Management Science, 35*(12), 1504-1511.

Dixit, A. (1992). Investment and hysteresis. *Journal of Economic Perspectives, 6*(1), 107-132.

Federman, Brad. (2009). *Employee engagement: a roadmap for creating profits, optimizing performance, and increasing loyalty*. [Books24x7 version] Available from http://common.books24x7.com.ezproxy.rit.edu/toc.aspx?bookid=31874.

Gersbach, H., & Wehrspohn, U. (1998). Organizational design with a budget constraint. *Review of Economic Design. 1998, 3*(2), 149.

Halal, W. E. (2015). Business Strategy for the Technology Revolution: Competing at the Edge of Creative Destruction. *Journal of the Knowledge Economy, 6*(1), 31-47.

Hammermeister, J. (2005). *Management control systems, strategy, and organization effectiveness: A transaction cost economics perspective.* (3178213), Nova Southeastern University, Ann Arbor.

Hansen, M. T. (1999). The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly*, *44*, 82–111.

Higgins, J. M. (2005). The Eight 'S's of successful strategy execution. *Journal of Change Management, 5*(1), 3-13.

Hsu, I., & Sabherwal, R. (2011). From intellectual capital to firm performance: the mediating role of

knowledge management capabilities. *IEEE Transactions on Engineering Management*, *58*(4), 626-642. doi:10.1109/tem.2011.2111455

Hull, C. E., Baroody, A. J., & Payne, B. R. (2007). Supplementing the six facets model of technology management with a modified analytic hierarchic process: The effective evaluation of new technology prior to implementation. *International Journal of Innovation and Technology Management*, *4*(1), 59-68.

Jennesson, E., Nilsson, F., & Rapp, B. (2014). *Strategy, Control and Competitive Advantage (1st ed.)*: Springer-Verlag Berlin.

Kaplan, R. S., & Norton, D. P. (1992). Balanced scorecard: measures that drive performance. *Harvard Business Review, 70*(1), 71-79.

Kearns, M. B., Taylor, J. B., Hull, C. E. (2005). The six facets model: technology management in the effective implementation of change. *International Journal of Innovation and Technology Management, 2*(1), 77–100.

Kotter, J.P. 2013. *The secret formula for corporate strategy execution*. [Online] Available: http://www.forbes.com/sites/johnkotter/2013/01/07/the-secret-formula-for-corporate-strategyexecution/Accessed: 17 November 2016.

Kortelainen, S., Kutvonen, A., & Torkkeli, M. (2012). Open innovation versus transaction cost economics. ISPIM Conference Proceedings, Manchester.

Kwon, H.-J. D. (2008). *The impact of uncertainty on operational decisions.* (3322021), University of California, Los Angeles, Ann Arbor.

LID. (2015). *Developing motivation and employee engagement: enabling people to succeed*. [Books24x7 version] Available from http://common.books24x7.com.ezproxy.rit.edu/toc.aspx?bookid=104262.

Liao, A., Hull, C. E., & Sriramachandramurthy, R. (2013). The six facets model of technology management: a study in the digital business industry. *International Journal of Innovation and Technology Management*, *10*(4), 1350019.

Liu, M., Hull, C. E., & Hung, Y. T. C. (2017). Starting open source collaborative innovation: the antecedents of network formation in community source. *Information Systems Journal*. *27*(5). DOI: 10.1111/isj.12113

Liu, M., Wu, X., Zhao, J. L., & Zhu, L. (2010). Outsourcing of community source: identifying motivations and benefits. *Journal of Global Information Management (JGIM)*, *18*(4), 36-52.

Luxmore, S. R., & Hull, C. E. (2010). Externalities and the six facets model of technology management: genetically modified organisms in agribusiness. *International Journal of Innovation and Technology Management*, 7(1), 19-36.

Mahoney, J. T., & Pandian, J. R. (1992). The resource-based view within the conversation of strategic management. *Strategic Management Journal*, *13*(5), 363-380.

Mariadoss, B. J., Johnson, J. L., & Martin, K. D. (2014). Strategic intent and performance: The role of resource allocation decisions. *Journal of Business Research*, *67*(11), 2393-2402.

Mercier, D. (2002). Integration of financial and strategic planning using a real options framework bolsters capital spending decisions. *Oil & Gas Journal, 100,* 77-81.

Messica, A., & Mehrez, A. (2002). Time-to-market, window of opportunity, and salvageability of a new product development. *Managerial and Decision Economics, 23*(6), 371-378.

Mintzberg, H., (1987). The strategy concept I- Five Ps for strategy. *California Management Review,*

30(1), 11-23. DOI: 10.2307/41165263
Mintzberg, H., (1987). The strategy concept II- Another look at why organizations need strategies. *California Management Review, 30*(1), 23-32. DOI: 10.2307/41165264
Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*(2), 147-175.
Nahapiet, J. & S. Ghoshal, (1998). S. Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review, 23,* 242–266.
Prahalad, C. K., & Hamel, G. (1990). *The core competence of the corporation* (pp. 1-15): Harvard Business School.
Ramanujam, V. and P. Varadarajan. (1989). Research on corporate diversification: A synthesis. *Strategic Management Journal, 10*, 523-551.
Remneland-Wikhamn, B., & Knights, D. (2012). Transaction cost economics and open innovation: Implications for theory and practice. *Creativity and Innovation Management, 21*(3), 277-289. doi:10.1111/j.1467-8691.2012.00639.x
Rotch, W. (1993). Management control systems: One view of components and their interdependence. *British Journal of Management, 4*(3), 191-203.
Schumpeter, J. A. (1942). *Socialism, capitalism and democracy*: Harper and Brothers, New York.
Seland, D. (2010). Creative Destruction. *CircuiTree,* January, 6.
Tan, J., & Peng, M.W. (2003). Organizational slack and firm performance during economic transitions: Two studies from an emerging economy. *Strategic Management Journal*, 24(13), 1249–1263.
Tanriverdi, H. (2005). Information technology relatedness, knowledge management capability, and performance of multibusiness firms. *MIS Quarterly, 29*(2), 311–334.
Teece, D. J. (2000). Strategies for managing knowledge assets: the role of firm structure and industrial context. *Long Range Planning, 33*(1), 35-54.
Tollison, R. D. (1982). Rent seeking: A survey. *Kyklos, 35*, 575-602.
Walsh, J. P. and Ungson, G. R. (1991). Organizational memory. *Academy of Management Review, 16*, 57–91.
Zagotta, R. & Robinson, D. (2002). Keys to successful strategy execution. *Journal of Business Strategy, 23(1),* 30-34.